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PREFATORY NOTE.

THE attention of the readers of this Series of Lectures is directed to the Fourth Annual Report by the Committee of the Edinburgh Health Society, presented to the Meeting of Members on 31st January last, which is appended to this volume.

EDINBURGH, *April* 1885.

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EDINBURGH, *April* 1885.

JAMES WATSON, *Manager.*

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ON CERTAIN SOCIAL ASPECTS OF INSANITY.

By Dr J. BATTY TUKE, M.D., F.R.C.P.E., F.R.S.E.

In the two Health Lectures I have had the pleasure of delivering under the auspices of the Edinburgh Health Society, I directed attention to the structure of the brain, to its functions, and to certain perversions of its functional activity. I insisted very strongly on the fact that insanity was *a disease of the brain with mental symptoms.* This is a short succinct definition, which like most definitions fails to include and exclude all that should be included or excluded. At one time it was my intention to go more deeply into this subject to-night, and to have shown you our reasons for believing that it would be more accurate to say that insanity was a symptom of many morbid conditions of that organ. But I soon found that the subject was far too complex to deal with in one lecture addressed to a popular audience, and that no tangible good would be likely to result. It would be a mere tickling of public curiosity which might be actually harmful. For after my last lecture, in which I took up some details connected with the natural history and symptoms of insanity, I received a large number of visits and a perfect shoal of letters from persons who thought they could trace some connection between my remarks and their personal experiences and symptoms. For the most part the connection was entirely imaginary. For this and other reasons I do not deem it wise to put up butts for nervous people to shy at, and will therefore confine myself to-night to certain general questions connected with insanity. And besides all this the subject is such a sad one. Taken over all I

know of no more dire and distressful diseases than those which are comprised under the generic term of insanity. Of course all disease brings more or less acute misery in its train, misery to the sufferer and misery to friends and relatives. But insanity entails even more poignant anxiety and trouble. The affected person is a changed being, shut off mentally from the home circle. In ordinary disease, as a rule, the sufferings of the patient can be relieved by the cheering influences of home, whereas in the case of insanity the patients are, for the most part, debarred from such alleviations. The nature of the disease is such that in the large majority of cases it is absolutely necessary to remove the man or woman mentally afflicted from the family, and submit him or her to the treatment of strangers. I repeat, I know of no more melancholy disease, or one that demands greater sympathy. And yet is it not curious that there is a certain savour of the comic and grotesque associated in the public mind with mental disease and defect? If, in proof of this assertion, we turn to the comic papers, we constantly find paragraphs supposed to be dated from lunatic asylums, or communications from our "Insanitary Correspondent," and so on. Insanity serves as a peg on which to hang jocular remarks, without consideration for the feelings of many mentally afflicted persons who are quite able to appreciate the cruelty of the proceeding, or without thought for the sensibilities of their connections. No one makes a jest of cancer or consumption; and I feel certain that if the professional joker would but reflect how helpless his butt is, and how sad his condition, he would refrain from expending his wit in such a direction. I freely admit it is often impossible to repress a smile as one listens to the incongruous statements of the insane; but this is a very different thing from sitting down deliberately, pen in hand, to make capital out of the peculiarities of the maniac or idiot. I do not choose to run the risk of being accused of making capital out of the details of this distressing subject, even for the purposes of a Health Lecture, and therefore will keep myself to the general question. In so doing, I cannot injure individual susceptibilities.

I cannot attack any of the many social aspects of lunacy unless I give you a brief sketch of the history of the treatment of insanity, for, of course, out of it have originated all social aspects. The history of the treatment of the mentally afflicted has been well stated to be divisible into three epochs—the barbaric, the humane, and the remedial. But this does not take into account the very humane and probably highly remedial system of treatment which obtained in very ancient times. In Egypt the temples of Saturn, and in Greece the Asclepian hospitals, were resorted to by those mentally afflicted, and the treatment there adopted was identical in principle (and perhaps superior in practice) with that of the present day. The directions given by all the classical medical authors, and especially by Hippocrates, who flourished 400 B.C., and by Galen, who practised a century B.C., are of the soundest character. How long their influence existed it is difficult to say, but in the middle ages little or no attention was paid in Great Britain or elsewhere to the care or cure of the insane. In 1537, a house in Bishopsgate Street, London, fell into the possession of the Corporation, and was appropriated for the reception of fifty lunatics. This, the first Bethlehem Hospital or Bedlam, was removed in 1675 to Moorfields, and in 1814 the present magnificent hospital was erected in St George's Fields. Another hospital, St Luke's, was instituted in 1751. Bedlams, or houses of detention for lunatics, appear to have existed in other cities, but with these exceptions no provision was made for the insane, who were allowed to wander at large. There is only too good reason for believing that many hundreds, I fear I am not exaggerating when I say many thousands, were executed as criminals or witches during this barbaric period. About 1750 the condition of the insane attracted some amount of public attention, and the incarceration in mad-houses of a considerably larger number than formerly followed; not on account of any philanthropic sympathy with their condition, but as a measure demanded for the public safety and comfort. But this measure by no means brought about the termination of the barbaric period. The houses misnamed Asylums were in the hands of private parties, under

little or no supervision, and were in fact merely prisons of the very worst description. The unhappy inmates were immured in cells, chained to the walls, flogged, starved, and not unfrequently killed. It is almost impossible to believe, but it is none the less true, that this condition of matters existed far on into the present century. According to Conolly, "there is clear proof of the continued existence of these abuses in 1827; and it cannot be denied that not a few of them survived in some public and private asylums in 1850." I myself, and I am not an old man, have seen maniacs restrained by shackles and manacles, and confined in cells of the most sordid description. Matters were no better in France when the brave Dr Pinel was appointed in 1792 to the charge of the Bicêtre, the great hospital of Paris for male lunatics. In that establishment, and in the Salpetrière (another great hospital), the condition of the inmates was as degraded as in the British mad-houses. This great philanthropist adopted the bold step of striking off the chains and other engines of restraint from those under his care. About the same time, the most gross abuses having been brought to light in connection with the management of the City of York Asylum, William Tuke, a member of the Society of Friends, was mainly active in instituting the York Retreat for the care and cure of the insane members of the Quaker sect. This was the first Asylum instituted in Great Britain conducted on real non-restraint principles. The names of these two men are indissolubly connected with the humane treatment of the insane, and to their efforts must be ascribed the awakening, not only of the public but of the medical profession to the true principles of management of the insane and to the proper system of studying insanity. Various Committees of the House of Commons were appointed, the first being in 1806, from the reports of which emanated the various Lunacy Acts and their amendments, which aimed at the regulation and control of all constraint applied to the insane. As a consequence County Asylums were established for paupers in England, power being given to the magistrates to charge the expense upon the county rate. It was not till 1855 that a Royal Commission was ap-

pointed to investigate into lunacy matters in Scotland. This tardiness was due to the existence of chartered Royal Asylums at Edinburgh, Glasgow, Perth, Montrose, Dundee, Dumfries, and Aberdeen, which had been established at various periods between the years 1798 and 1840. But the resources of these institutions being overtaxed, and doubts having arisen as to the proper management of private pauper asylums, a Royal Commission was issued, on whose recommendation a Lunacy Board for Scotland was established, the country divided into districts, each of which was compelled to build accommodation for the pauper insane, and all private asylums for paupers were gradually abolished.

I must ask you to accept this resumé of the history of the treatment of the insane, brief and imperfect as it is, as time will not permit me further to elaborate it. But I think enough has been said to enable me to approach those aspects or phases of popular opinion springing from it, to which I desire particularly to direct your attention to-night. I will endeavour to treat of these under three heads. The first is the feeling of doubt and suspicion which still lurks in the public mind as to lunacy administration and lunatic asylums. In the second place I intend to combat certain popular errors which have arisen out of the action of legislation; and thirdly, we shall inquire whether in certain matters we are not too well satisfied with the management of the insane as it at present exists.

The feeling of doubt and suspicion as to lunacy matters is, I am happy to say, distinctly on the wane. In whatever strength it exists, it is the natural outcome of the popular recollection of the stories of cruelty, wrong, and inhumanity which startled the public mind in times gone by, and called forth much powerful and painful feeling. Such feelings die hard. But apart from this the Briton ever jealously watches over the liberty of the subject; and he watches all the more jealously when misfortune, not crime, tends to deprive the citizen of freedom. Now I think I am justified in saying that this feeling of doubt and mistrust exists much more strongly in England than in Scotland, and I believe this part of our subject will be best

opened up if we inquire into the reasons for this difference of intensity of feeling between the two countries. My own impression is that this phase of popular belief was never deeply rooted in Scotland, in consequence of the long existence of those noble institutions—the Royal Chartered Asylums. It is true somewhat similar hospitals existed in England, but these, for the most part, were administered by close corporations. In Scotland, however, the Committees of Management of the Royal Asylums have always been largely representative, consisting of delegates from the municipal, clerical, legal, and medical bodies connected with the cities or towns in the neighbourhood of which these institutions are situated, of county magistrates, and of other eminent citizens. In some instances Committees of Management are very numerous, in one instance numbering over a hundred, and in another forty. Such large memberships, although somewhat cumbersome, have had the good effect of keeping the public mind at rest, and the administration of these institutions has always been characterized by liberality and judgment. The Royal Asylums of Scotland came out of all official enquiries with unsullied, nay enhanced reputation, and as a consequence their original constitution has never been interfered with. Another important agent, which has kept down doubt and mistrust in Scotland, is the legal procedure by which an insane person is received and detained in an asylum. In this country, when such a step becomes necessary, a responsible person, such as the Inspector of Poor, or a relative of the patient, must obtain two medical certificates that the person proposed to be confined is insane; which having been obtained, he must present a petition, accompanied by a statement of particulars and the medical certificates to a Sheriff, who, if satisfied, grants an order to the superintendent of an asylum to receive and detain. This is a calm judicial process, which is applied alike to pauper and to private patients—the rich and the poor are detained on identical legal instruments. In England matters stand otherwise. In the case of private patients it is necessary to have what is termed an "order," signed by any one having a reasonable right to inter-

fere, accompanied by two medical certificates. The schedule is not laid before a judge, or any other legal authority, and the patient is received and detained on the strength of this order and the medical certificates. In the case of pauper patients only one medical certificate is demanded, accompanied either by the order of a Justice of the Peace, or by an order signed conjointly by the relieving officer (who corresponds to our inspector of poor), and an officiating clergyman of the parish. I am very far from saying that this system is abused in England. I am certain in fact it is not. All I say is that it is much more open to suspicion than the Scotch procedure, and that the judicial element does not enter sufficiently into it. Nor do I mean to say that the Scotch procedure entirely precludes the possibility of the improper transmission of a person to an asylum. It is impossible for a Sheriff to criticise each case as it presents itself; still he has the power to do so, and does do so, when anything informal appears on the face of the schedule, or when he considers the medical certificates unsatisfactory. Moreover, the public knows that it is extremely unlikely that any two medical men would combine with a third and a fourth person for a nefarious purpose, when the necessary instrument must receive the signature of an important magistrate. It is a wise and satisfying procedure, in the working of which no difficulty is found. Perhaps the best evidence of its usefulness is the fact that not a single case involving the question of improper or illegal detention in an asylum has been originated before our courts for upwards of twenty years, and that since this procedure has been instituted no instance has occurred in which the charge has been substantiated. But Scotland possesses another important safeguard; it is a small country, with a limited population, and its lunacy matters are under the control and supervision of a well constituted General Board of Lunacy. This Board consists of an unpaid chairman, two unpaid legal and two paid medical commissioners, who supervise 29 asylums, 10 poorhouse wards for the reception of pauper lunatics, and 3 training institutions for imbecile children. These various institutions contain about 6500 patients.

Each of the medical commissioners visit each asylum at least once a year. Now the practical result of this is that these officers become personally acquainted with every case of any particular importance—important I mean as regards the propriety of detention. In England there are 6 commissioners, 3 of whom are lawyers, and all of whom receive high salaries. In visiting the various asylums a legal and a medical commissioner hunt in couples. What practical use this is I fail to understand, nor have I ever received a reasonable answer from any one competent to judge whom I have consulted on the subject. It would sound simply ridiculous to us in Scotland were it proposed to start an advocate or a writer to the signet in company with a doctor to make tours round our hospitals. The 3 medical commissioners have to visit something like 140 asylums, each pauper institution being visited once, and each private one twice a year, but not by the same men time after time. I submit that considering the enormous size of many of the institutions, the immense number of patients to be seen, and the great extent of their peregrinations, it is impossible for the English medical commissioners to have the same individual knowledge of patients as ours have. Three such officers have to inspect some 50,000 lunatics, whereas in Scotland something like 6500 are inspected by two commissioners. It has been suggested that our officials are not overworked, that in fact one medical commissioner would be sufficient; but apart from all other considerations, if these two officials maintain public confidence their not extravagant salaries are well expended public money. At the present moment in England there is a general feeling of uneasiness regarding the whole subject of lunacy administration, excited by various recent trials, and other investigations conducted within the last few years; and it is highly probable that the question in some form or other will be brought up before the next session of Parliament. My humble opinion is, that the line reform should take in England is in the direction of the adoption of the Scotch system. In the first place the legal instrument for the reception and detention of the lunatic should be made identical with our Sheriff's order, the county court judge exercis-

ing the function of our Sheriff. Secondly, that the General Board of Lunacy should be improved by the conversion of the legal into medical commissioners, the number of whom should be increased to 10 or 12. Third, that England and Wales should be broken up into lunacy districts each of which should contain not more than 10,000 lunatics. Fourthly, that two medical commissioners should be appointed to each district, which they should visit regularly twice a year. And lastly, that honorary legal commissioners should, as with us, be appointed, whose duties should be confined to advising at meetings of the General Board on cases submitted by the medical officials. I believe by this means public confidence in England would be established, and that the same elasticity of management as exists in Scotland would be obtained. Our Board having the whole of our institutions immediately under its eye, can and does allow great latitude of action in the management of individual asylums, which is impossible under existing circumstances in England, where there is a much greater tendency towards officialism and red tape.

I trust I have said enough on this subject to show you that in this country not only is the liberty of the subject most carefully guarded, but also that the interests and well-being of the insane are sedulously attended to.

Passing to the second head—popular errors arising out of the action of legislation—the error which I particularly wish to combat is the somewhat wide spread one that lunacy has become considerably more prevalent during the last quarter of a century. This opinion is based on the fact that in the year 1859 the returns made to the office of the Commissioners of Lunacy for Scotland showed 6072 lunatics, whereas in 1880 they showed 9624. There is thus a ratio of 157 per 100,000 of the population in the former year, as against 217 per 100,000 in the latter. These figures are somewhat startling, and it is not unnatural that they should have suggested the conclusion I allude to, which has also been fostered by the greatly increased expenditure on asylums and their inmates laid upon the ratepayer. Time will not

serve to-night to go into any great detail on this important subject. I can only state to you that there is a pretty general consent of all authorities, that if there has been an actual increase of lunacy over the whole population it is but very slight, and that the apparent increase is due, first, to the improved systems of registration instituted by the Board of Lunacy, which have brought under its cognizance a great mass of cases which were formerly neglected, "who would not have been dealt with as paupers in 1858, but who are now dealt with as such, so as to obtain for them the advantage of accommodation in pauper asylums." Secondly, a further and far more powerful reason is to be found in the increasing tendency among all classes, and especially among the poorer class, to recognize the less pronounced forms of mental disorder as being of the nature of insanity, and requiring to be dealt with as such. Thirdly, the grant of four shillings per week per head which in 1876 was made by Parliament from imperial sources for the maintenance of pauper lunatics has induced parochial authorities to regard as lunatics a large number of weak-minded paupers, and to force them into asylums in order to obtain the benefit of the grant and to relieve the rates. This I believe to have been a very evil piece of legislation, which has tended to glut most of our public institutions, and, to a certain extent, to have impaired their efficiency. It is impossible at present to go further into this question; but anyone specially interested in the subject will find ample justification of the opinion in the Commissioners' reports, and in the annual reports of the superintendents of most public asylums. The views just advanced receive support from the fact that the increase of private patients, *i.e.*, patients who are provided for out of their own funds or those of the family, has advanced in a vastly smaller ratio. In their case the increase, small as it is, can be accounted for by the growing disinclination on the part of the community to tolerate irregularities of conduct due to mental disease, and the consequent relegation of its victims to asylums for the sake of family convenience and comfort. And again, careful inquiry has failed to show a proportional increase of

admissions into asylums of cases of certain well marked and definite forms of insanity. The main cause of the increase of registered lunatics is thus to be sought for in improved registration and parochial and family convenience. If there is an actual increase, and there is reason for believing that there is a slight actual increase, it is due to the tendency of the population to gravitate towards towns and cities, where the conditions of health are inferior to those of rural life, and where there is therefore a greater disposition to disease of all kinds.

But a loud cry has arisen in England, which within the last few months has increased to a shriek, that another baneful influence is rapidly sapping the foundations of public health. Dr Crichton Browne, in a report to the Education Department upon the alleged over-pressure of work in Public Elementary Schools, informs us as the result of his investigations that the seeds of disease are being sown broadcast by the schoolmaster. We are led to infer from this report that water on the brain, various diseases of the kidney and heart, insanity, and suicide are increasing year by year, and that the main cause of this increase is over-pressure in Elementary Schools. This authority, I should premise, asserts that there is no over-pressure in Scotland ; but I deny that his experience is such as to warrant any expression of opinion as regards this question ; for his experience in Scotland is confined to five small schools in a purely agricultural district in Dumfriesshire, attended by children of Scotch parentage, belonging to the farming and peasant class. It is quite unfair to collate such experience with that derived from observation of schools situated in the lowest parts of London, attended by children drawn from the substratum of society. I repeat Dr Crichton Browne's experience in Scotland is of no value as affording a standard of comparison with the state of matters in England. In order to have gained anything like equivalent experience he should have visited Board Schools in the large Scotch cities. In London he examined 6500 children, most of whom were resident in the poorest and most squalid districts of the metropolis, and the results of his investigations are of the most sensational

character. As regards his remarks on the increase of the various diseases just mentioned, I will not occupy your time long. He certainly shows, from the reports of the Registrar-General, a gradual progressive increase of hydrocephalus and inflammation of the brain since 1861. This, in all probability, is merely the result of changes in medical terminology. For when we turn to the statement lately made by Sir Lyon Playfair, based on a paper in the Journal of the Statistical Society (June 1883) by Mr Noel Humphreys, we find Dr Crichton Browne's figures blown to the winds. Sir Lyon Playfair stated then, as the result of his statistical enquiries, that since the Board Schools have been in thorough working order there has been a diminution in the death-rate of children between 5 and 15 to the extent of 22 per cent. I am by no means prepared to believe that this great decrease is entirely due to educational influences, but I think the statement of so much importance that I shall add as an appendix to this lecture that portion of Sir Lyon Playfair's speech which bears on the subject. His figures being demolished, the real interest of Dr Browne's report centres in the statement that out of 6500 children whom he examined, 3034, or 46·1 per cent., suffer from habitual headache, or as he puts it in the only cautious sentence in the report, "*professed* to suffer from headache habitually." Now I must read to you how Dr Browne arrived at this conclusion.

"It may of course be objected that my results are not trustworthy. Children, it may be argued, are at once imitative and reckless, and will readily assume a headache, if they have it not, whenever that ailment seems to be fashionable amongst their companions. To ask the victims of headache in a large body of children to declare themselves, is really, it may be said, to invite malingering. But such objections to my results, however specious in appearance, could not be advanced by any one who had witnessed my method of inquiry, and my own conviction is that the figures which I submit as representing the prevalence of headaches amongst metropolitan school children fall short if anything of the truth. There seemed often to be a reluctance on the part of the children to admit their liability to headaches.

In some cases in which my professional title had been emphasised in my introduction to the standard, the idea got abroad that any admission as to headaches, in reply to my questions, would be followed by the administration of physic on the spot. In other cases it appeared that confused notions as to human responsibility led to the belief that headache was a moral delinquency, the confession of which would be followed by caning or keeping in. And in still other cases it was evident that an apprehension existed that the acknowledgment of headache would be regarded as a reflection on the teacher, whose agency in their production was obscurely recognised. I had to do my utmost to gain the confidence of the children, and to secure the co-operation of the teachers, before any fair census of headaches could be taken. My impression is that after all some wary little London urchins thought it prudent to keep their cephalgias to themselves, and that my figures are therefore rather under than over the mark. Great pains were however taken to secure accurate returns. In each standard some of the children were themselves asked to explain what was understood by a headache, and when this point was satisfactorily settled, the whole number present were exhorted to think carefully whether they ever suffered from headaches. It was impressed on them that an occasional headache, that is to say a headache at Christmas time, or after a Bank holiday, once in six months, or once a month, was of no account, and the question was then put, How many boys or girls here suffer from headaches often, or now and then? In answer to that question a little grove of hands was invariably held up, and the promptness and simultaneity with which the hands were raised, certainly created the presumption that they revealed a genuine experience. In any presumption of that kind, however, I did not rest. Having pointed out that headaches might occur in the morning, afternoon, or evening, or that even if they lasted all day they might be worst at one of these periods, I begged the children in all the schools which I examined to think when their headaches troubled them most, and then proceeded to count the hands that were held up for morning, after-

noon, and evening respectively. And it is a remarkable fact that in seven or eight cases out of ten the sum of hands held up for these three periods exactly agreed with the total number of hands held up in the first instance by the children who professed to suffer from headaches ; and in the two or three cases out of ten in which any discrepancy occurred, it always turned out on further investigation that this arose from the difficulty which a few children felt in determining to which division of the day they should refer a long-continued headache. When out of a class of 60 girls, 30 confess to habitual headache in the first place, and when on further investigation it is found that 6 complain of morning headache, 14 of afternoon headaches, and 10 of evening headaches, there are surely good grounds of believing that we are dealing with facts and not with vain imaginations.

"But further tests were frequently applied. A localisation of the headache was insisted on in most of the schools examined latterly, and after it had been pointed out that the pain might be in the forehead, or on the top, or at the back of the head, a show of hands was demanded for each region. And, again, I may remark that it was a striking fact, and one to me very illustrative of the good faith and accuracy of the children, that in a large majority of instances the sum of the frontal, vertical, and occipital headaches corresponded exactly with the number of headaches originally noted."

I appeal to you, does not this sound very much like a page taken from Mark Twain? Dr Browne says on a previous page that from 20 to 30 per cent. of the London elementary school children are bright and clever, 40 to 60 per cent. of average intelligence, and 20 to 30 per cent. are stupid or backward. Now from my point of view this cannot be correct, as I cannot refuse the inference that 46·1 per cent. are singularly acute children who are able on the spur of the moment to determine, not only whether they have had headaches within the month, but to state definitely the period of the day at which the pain occurred, and to localise its position as regards the forehead, the top, or the back

of the head. And then those 30 girls, 6 of whom had a headache in the morning, 14 in the afternoon, and 10 in the evening —none of them, mind you, having a headache extending over the whole day—offer one of the most extraordinary clinical experiences ever reported by a physician.

In order to see for myself whether anything like the same condition of things existed in our own city, I lately took the opportunity of visiting four of the Edinburgh Board Schools in which 3500 children were receiving instruction. I paid special and particular attention to the condition of the children in those schools which derive their pupils from the poorest and most squalid parts of the city. Of course I found evidence of disease in a proportion of the children,—it was borne on their faces,—and if I had gone over them all with my stethescope, doubtless I would have found further evidence, but I found no evidence of habitual headache. One test I frequently applied was, I think, quite as trustworthy as that employed by Dr C. Browne. All the children who had been absent from school during the previous fortnight were told to stand up, and were then separately interrogated as to the cause of absence. In certainly not 1 per cent. was a "sair head" assigned as the cause. I also applied Dr Browne's test to several classes with a similar result. I will only give you the details of one such experiment, which seemed to me to be the most crucial, as the children forming the class were, for the most part, drawn from the rookeries and cellars of the Canongate or Cowgate. The master explained the nature of a headache most elaborately to a class of 110 children, and then ordered all who had suffered from such symptoms within the last month to stand up. Of 56 boys, 2 rose, one of whom stated that his pain was caused by falling down stairs while playing; of the girls, 3 stood up, one of whom was evidently suffering from headache, the other two were the subjects of occasional epileptic fits. In other classes submitted to this test, similar numerical results were obtained. My own belief is that the results of these experiments were not one whit more trustworthy than those of Dr C. Browne's.

The only impression conveyed to me was that Scotch Board children had not such a keen sense of humour as the London Arab is reported to have. I appealed to many of the teachers as to whether they had any reason for believing that headache was a common school complaint. All of them knew of individual instances, but the disease newly invented in London called "Board headache" was unknown. It was admitted that a certain amount of extra pressure, or, as I should call it, kindly tutorial teaching, was applied to backward children in order to prepare them for examination; but I saw no evidence of what is thus described by Dr Browne:—"Knots of children may be found standing in the playground, neglecting hop-scotch and skipping-rope, and speculating like precocious gamesters on their chances of passing, and the questions that are likely to be asked them. The supernatural terrors of the past have given place to dread of the School Board. The infantile lip that would curl with contempt at any reference to a witch or a ghost, quivers with anxiety at the name of a Government inspector, and the examination day has appropriated to itself much of the foreboding which used to be reserved for the Day of Judgment."

As regards London, Dr Crichton Browne has made the unfortunate mistake of proving too much, and as regards Scotland, from lack of experience, he has proved too little. I believe in both countries there is a certain amount of over-pressure in elementary schools, but that in the former the cry is much louder than there is any ground for. The case against over-pressure is summed up in a sentence of the Report of the Edinburgh Committee for Feeding and Clothing Destitute Children:—"If there is any danger of over-pressure in our elementary schools, it is mainly, if not wholly, due to the presence in these schools of the half-starved ill-clad children to be found in every large town where attendance is enforced under the compulsory provisions of the Education Acts, and whose progress is measured by the same standards applied to the well cared for children of the artisan classes." To this extent we admit the existence of over-pressure, and there is no reason for believing that the amount of

pressure differs materially in London, Edinburgh, Glasgow, and Manchester. It is a palpable blot on our educational systems, to the wiping out of which it would have been well if Dr Crichton Browne had directed his attention instead of stimulating by extreme statements the general popular dislike of education which exists in England, and out of which has sprung the main root of the agitation. There is nothing in the various standards but what any fairly nourished, not mentally deficient, child can easily overcome. If over-pressure does ever occur amongst children of the artisan class, the fault lies with the parents in not making representations to the head-master that their children are not able to overcome their tasks, and suffer in the effort. It is a little too much the custom of parents of all classes to consider that their duty to their children is finished when the school fees are paid. Any representation to the proper authority is carefully considered, and, if found reasonable, exemption from examination is granted. But, as a matter of fact, I am assured by all the Scotch teachers whom I have consulted, the most common complaint is that children do not get enough to do.

The most enthusiastic admirer of our educational systems does not maintain that they are perfect,—he will even admit that certain of the principles of the codes are open to criticism. But to be told that the State is educating the people into insanity is one of those wild expressions which defeats its own aim and object. Speaking as a physician, I assure you that day by day I meet with hysteria, hypochondriasis, insanity, nervous disease in endless forms, springing out of idleness and ignorance. The risks to public health of over education are far less than those of under education. Thanks to John Knox and the other formulers of the parish schools, thanks to our universities, which are truly universities for the people, Scotland has been for centuries a highly-educated country. Can it be said that nervous disease is more prevalent here than in England, where the standard of general education has been much lower? It is not, as a matter of fact, either in kind or degree; and you need have no fear that education will tend to deterioration of nerve force.

I fear you will think I have spent too much time on this incidental subject: but I could not resist the impulse of entering a protest against statements made by a medical authority of reputation tending to discredit the great work of the Educational Department, statements which although supported by specious statistics and biassed observation are none the less dangerous.

I will treat of the third head as shortly as I can. It is contained in the question, Are we not too well satisfied with the management of the insane as it at present exists? I think we are, and the following are my reasons for my belief.

Following on the action of legislation and the consequent greatly increased number of pauper lunatics, there came of course at once a demand for increased asylum accommodation. This was met by the erection of county and district asylums and by the addition of new departments to old establishments. The demand was not only originally great, but it became continuous and constant, so much so that within a few years of the erection of a county or district asylum it was found in almost every instance absolutely necessary to make extensive additions. It passed into a common saying that it was only necessary to build an asylum in order to get it filled, and that the more you built the more you might build. This process of constant additions produced in a comparatively short space of time many monster asylums. There are in England at the present moment several such gigantic institutions, containing over two thousand patients, and in Scotland we have at least two, accommodating from six to seven hundred patients. Now, notwithstanding the admirable administration and active supervision of the governing bodies and medical superintendents of large institutions for the insane, I am by no means sure that they afford scope for the best and most scientific system of treatment, or that the earnest and energetic physicians at their heads are afforded full opportunity for exercising their function. Having myself been connected with such institutions as a subordinate and as a head, I feel no delicacy in criticising what I believe to be their defects, or in suggesting measures for their amendment. If we review the statistics of

insanity of fifty years ago, and compare them with those of the present day, we will find that there has been no sensible increase in the percentage of recoveries. Referring to Dr Thurnam's book on the statistics of insanity, published in 1845, we find him stating:—"Examination will, I think, justify the conclusion that, as regards the recoveries in asylums which have been established during any considerable period,—say twenty years,—a proportion of much less than 40 per cent. of the admissions is, under ordinary circumstances, to be regarded as a low proportion, and one much exceeding 45 per cent. as a high proportion;" and turning to Dr H. Tuke's History of the Insane in the British Isles, we find him stating:—"The number of patients discharged cured in County and Borough Asylums during the ten years 1871-1880, was 40·30 per cent. on the admissions." In the face of the fact that during the period intervening between these two statements great improvements have been effected in the treatment and accommodation of the insane, it is surely justifiable to endeavour to seek for a cause why these improvements have not been productive of better results. The causes, I believe, are two-fold: 1st, overgrowth of old asylums, and 2nd, deficient accommodation in both old and new institutions for hospital treatment. The larger an asylum grows the more rigid must discipline become, and the greater must be the tendency for the individual to be merged in the mass. In the treatment of the insane, we apply medicinal measures, and we apply moral treatment, and it is difficult to say which of these measures is the more important. The position may be not inaptly compared to a class in a school in which teaching and discipline run hand in hand, and we all know that the larger the class the smaller, as a rule, the results. In an asylum, discipline or moral suasion—call it what you will—ought to be applied as far as possible to the individual; and there, as in the school class, the more it is distributed, the less powerful its effects. You will perhaps be told that when a person becomes insane his or her individuality becomes changed; that may be so, but all the more must that changed individuality be submitted to particular and individual moral influences.

That our pauper patients do receive a considerable amount of such attention is not denied, but it stands to reason that the amount of this individual attention must be in inverse ratio to the size of the asylum. In our best public institutions, a good deal has been done in this direction: hospital blocks having been erected, in which recent cases and the sick from the general wards are submitted to treatment. But this does not to my mind fulfil all the conditions of a perfect hospital for the treatment of the insane. It is said to be unwise to prophesy unless you are sure of what is going to happen; but I do not feel imprudent in saying that I feel sure that the pauper asylum of the future will differ in many respects from that of the present. It will consist of at least two departments; one, a hospital in which new cases will be treated to recovery, or for such length of time as reasonable hope for recovery exists. This hospital will stand by itself, in grounds of its own, to which the chronic patients will not be admitted; it will be conducted on principles identical with those of a general infirmary; it will have a large staff of physicians and numerous nurses of the highest order. The other department will consist of an institution for the care and management of the chronic insane, where all the kindly influences which are at present applied, such as amusements, exercise, and work, will ameliorate the condition of its inmates, and may even in some cases procure ultimate recovery. On such a system the asylum physician will be able to apply medical treatment untrammelled by his present great difficulty, the intermixing of new and old cases. It may be said that this plan is utopian on account of expense; but the British public has not as yet been found parsimonious in great questions of public health. It is only necessary to instance the ready assent given by our citizens to the great city improvements of Edinburgh, and to the readiness with which £10,000 was subscribed when it became known that our old infirmary was behind the requirements of the day. Alongside of humanitarian considerations, economics may exercise their influence. Regarding the position from the lowest point of view, a pauper recovered from his lunacy means a

saving of many hundreds of pounds. A patient attacked by insanity at 20 years of age, and not recovering, will, if he lives to 60, cost his parish at least £800, and a great deal more if we reckon interest and compound interest; so that if by any reasonable means the public can afford the asylum physician the machinery of procuring even 10 per cent. more of recoveries than he at present can do, for he does all that he can, the speculation would be a good one.

But it will be said, can nothing be done with the great institutions which at present exist? The answer is distinctly in the affirmative. As soon as it happens, as surely it will happen, that each of them will require extension; let that extension be made in the direction of *lunatic hospitals*, not in the direction of new wings joined to the original buildings. Let a curative establishment be built remote from the asylum; the existing hospital wards can be used for chronic patients, and the separate establishment for recent and curable cases. With such a machinery ready to the hands of the enthusiastic and accomplished physicians who rule over the public asylums, I firmly believe you would soon find a steady diminution of chronic lunacy, consequent on an increased percentage of recoveries in hospital.

I have left myself but very little time to speak of a subject to which I desire to direct more particular attention. As regards it, I will merely read to you a sentence taken from a report which I submitted to the District Lunacy Board of Fife and Kinross many years ago:—"there is yet one other subject which I am desirous of bringing under the notice of your Board, and, through its influence, before the public. It is that some provision should be made for the assistance of patients discharged recovered, and who, being in good health and able-bodied, have no claim on their parish for relief. I have known of many cases for whose future welfare great anxiety has been experienced, consequent on their being unprovided with employment, and the difficulties they were sure to meet with in obtaining it as patients lately discharged from an asylum. Societies exist for the aid of discharged prisoners.

Surely the recovered lunatic's case appeals much more strongly to the sympathy and charity of the public. I have good reason for knowing that not a few of the relapsed cases which occur are the result of want of employment when they are restored to society, which restoration throws upon the individual the onus of self-maintenance, a burden he is ill able to bear." In England a society called the After Aid Society has been started. I offer a suggestion to the piously charitable in Scotland.

It is always a disappointment to a lecturer when he finds he has not left himself time for a peroration or exordium; but if his lecture is worth anything it needs no rhetorical conclusion. If I have been able to show you that lunacy administration in Scotland is creditable and above suspicion; if I have reassured your minds that insanity is not on the increase, and that the schoolmaster's influence is not in the direction of overcrowding our asylums; and if I have offered any suggestions which in time to come may be adopted for the benefit of the lunatic, my object has been attained.

APPENDIX.

Sir Lyon Playfair, M.P., on Over-Pressure in Schools.

From "Scotsman," *Nov.* 21*st*, 1884.

If I have not entirely exhausted your patience, there is one subject, which is already before Parliament, and must be seriously considered during the next session, that I think I ought to bring before you. It is the alleged over-pressure of children in schools. This subject may appear below our academic level and unnecessary to be discussed by your representative. But that is not so, for our Universities depend wholly upon the people; and if their education in the primary or secondary schools be overstrained, the most damaging effects may be produced as to their intellectual development in future life. The allegation is that the standards in the primary schools are above the capacities of children of this age, so that their health and mental powers break down in their overstrain to reach them. Many medical men show this fear, and some of them have the highest capacity for forming a correct judgment. Among these I need only mention my constituent and esteemed friend Dr Crichton Browne, who is one of the highest authorities on the subject of mental diseases, and whose opinions deserve to be treated with respect. I at once accept

his evidence that there are, in poorer schools in England, children who are physically and mentally unable to grapple with the standards to which they are put. He confines his observations to England, and says that there are no signs of over-pressure in Scotland. Certainly it is remarkable that the complaints do not come from Scotland, where the pressure ought to be higher, if we judge from the greater number of passes both among children and pupil-teachers. Neither do complaints come from Ireland, where they profess to have the same standards and pass a high percentage. But I do not doubt that cases exist in both these countries as well as in England, where miserable, sickly, half-fed and half-clothed children are unequal to tasks which may be suited to the average children in a school. I think that the discussion of the question has been most useful by drawing attention to such cases, which the Education Code now allows to be withdrawn from examination. Still it is possible that there has been a tendency to deduce extensive generalisations from exceptional cases. The standards of the code vary according to the age of children, and are considerably lower in their demands than the standards of any other country in Europe. They are far lower than those laid down by John Knox in his time, and yet our Scottish brains have still some substance left. The true principle is to lay down standards suitable to the large bulk of children of a certain age, and to make exceptions for stunted, sickly, and ill-fed children who are unable to reach them. I have tried to examine the subject on this principle, and to ascertain whether the standards are above the capacities of the great bulk of the young population at school. The health of children is a very sensitive barometer, for it rises or falls in immediate response to the condition of their environment. If we find a general increase in mortality among children since education became national and compulsory, depend upon it there is something essentially wrong in our educational systems. If, on the contrary, we find the health barometer rising, we may be satisfied that education is not deteriorating the masses, though it may still have unfavourable effects on individuals. But there are two factors in the question. Since 1870, the date of the English Education Act, there has been a great increase in school life; but there has also been a considerable improvement in public health, and due consideration must be given to each factor. This is easy to do, because bad sanitary surroundings tell most upon the life of children under five years of age, who are not at school; so that improvement in public health will show its largest result among these infants. As a fact, the mortality among children under five years of age has decreased since 1870 by 10 per cent., and this decrease must be credited to hygiene, including the improved habits of the people. If we now take the Registrar-General's returns of mortality for the decade ending in 1870, and compare that with the five years 1876-80, when the Education Act had got into play, the decreased mortality among school children between five and fifteen is 23¼ per cent. In the ten years preceding the Education Act, 1870, there was much activity in voluntary schools. A more striking comparison, therefore, comes out if we take the average of a longer period, when education was less prevalent—viz., 1838-54. This has been carefully done in the *Statistical Journal* for June 1883, to which I would refer you for details. The general results are these: that in the case of children of school age between five and ten, boys have a lessened mortality of 30 per cent., and girls of 33 per cent.; while between the ages of ten to fifteen

boys have a lessened mortality of 32 per cent., and girls of 35 per cent. If you deduct from these the 10 per cent., which give the maximum due to general hygienic improvement, you have to account for at least 22 per cent. lessened mortality among children of school ages. What has come into existence in the life of the nation to produce such a remarkable reduction in juvenile mortality? I know of nothing except the introduction of a universal school system. You have gathered the children of the poor from the streets and alleys of our large town, and from their overcrowded and insanitary homes, and you have placed them in well-heated, large, and well-ventilated school-rooms. You have enforced upon them cleanliness and habits of order, and the result has been, although you only intended to give them education, you have also given to them greatly increased health. To my mind these results are conclusive that, to the great mass of school children, our educational system has not only no deteriorating influence, but a powerfully ameliorating one. Still this does not remove from us the need of dealing with the exceptional cases in which evils have been shown to exist. Almost all the cases which have been made public—and we must remember that they are only a few instances among the 4½ millions at school—are breakdowns of children in the lower standards. As they get higher, the improving influences of the schools begin to tell. If I read aright the valuable medical warnings which we have received, they lead to these conclusions. A moderate amount of exercise of the body and of the brain are undoubtedly good for children as a whole. Thus a walk of one mile may not be too much exercise for ordinary children, but a walk of 100 yards may for rickety or under-fed children. So exercises in Standards I. and II. may be excellent for ordinary children, but they may be too much for under-fed weaklings. How is this to be met? It has been met in some cases admirably. In the city of London there is a Jewish school of 3400 children. They are of all nationalities, and are derived from the very poorest of our population. Yet the passes in the standards are very high, although a foreign language—viz., Hebrew—is added to their education. No complaints of over-pressure come from this school. The reason is that charity comes to the relief of the ill-clothed and half-fed children. Clothes are provided for the indigent, and a supplementary meal of bread and milk is given to all those who seem under-fed. The result has been to make all the children happy and eager for this school work. I am glad to say that this example is being now extensively followed, as an act of charity, among schools of the poorest kind, and with admirable results. You cannot do this at the cost of taxation, or of the rates, because that would be a large step towards Socialism; but charity can undertake to meet the exceptional cases in our schools. My excellent University colleague, Mr Campbell, who is always zealous in the promotion of education, described to us in Parliament a school in Scotland in which he was interested, and showed how, by giving food to under-fed children, the school passes became greatly augmented. The general result to which I have arrived, by a careful consideration of this question, is that we must be guided by medical experience in bringing charitable influences to bear upon the condition of ill-fed and ill-clothed children, so that the ordinary mental exercises, which are not too much for the great mass of our young population, may not bear too heavily on the feeble frames of the sickly and nervous weaklings.

DISEASE: WHAT ARE ITS CAUSES; HOW IS IT TO BE PREVENTED?

DERANGEMENTS OF NUTRITION.

By BYROM BRAMWELL, M.D., F.R.C.P. Edin.

Mr Chairman, Ladies, and Gentlemen,—The balloon is an important instrument of modern warfare, for it enables an observer to obtain a bird's-eye view of an enemy's position, and so affords most useful information both for the purposes of attack and defence. Now, disease is an enemy with which we have all at times to battle, and the object of my lecture this evening is to give you a broad and general, or a balloon-view, so to speak, of this enemy's position, to tell you some of the ways in which his assaults are made, and to show you some of the chief means by which they are to be guarded against and prevented.

The subject is of vast extent, and I shall not be able, in the brief limits of a single lecture, to enter into details. I shall have to confine myself to the most important points, and endeavour to sketch an outline for you, rather than attempt to draw a highly-finished picture; and remembering that these lectures are chiefly intended for those who are ignorant of anatomy, physiology, pathology, and the laws of health, I shall avoid technical terms, and shall endeavour to make the matter as simple and intelligible as possible.

Definition of Disease.—The first question which necessarily

meets us is, What is disease? I have spoken of disease as an enemy, but the comparison is not strictly and scientifically speaking accurate, for disease is not an entity—that is to say, a something which is separate and distinct from the body. The cause of disease often is an entity, but the disease consists of the functional and structural alterations which result from that cause. Let me give you an illustration: the introduction of a thorn under the skin of the finger may be followed by distinct disease. Now it is not the thorn but the inflammatory changes in the tissues due to the irritation produced by the thorn which constitute the disease.

Speaking generally, we may define disease as the opposite of health. This definition is a negative one, and in order to understand its meaning we must know what is meant by the term health. Absolute or perfect health is that condition in which every tissue in the body is absolutely perfect in structure and capable of functionating with absolute perfection. Health of this description is comparatively rare, and we are in the habit of speaking of health as that condition in which the vital functions are performed in a manner which experience has taught us to regard as normal; *vice versâ*, by the term disease we mean any deviation from the standard which we regard as normal. Practically, it is difficult or impossible to draw an absolutely sharp line of demarcation between health and disease; the two conditions may, speaking practically and not theoretically, be said to run insensibly one into the other. The beginnings of disease are often very insidious and gradual, slight infringements of the laws of health, which at first produce little or no appreciable disturbance, may, if frequently repeated, ultimately lead to organic disease; in fact, the innumerable little external and internal irritations which are constantly producing mere passing derangements of function in the healthy organism often ultimately become the causes of serious disease.

The definition of disease which I have just given you only takes into account the health of the individual as an individual, it entirely ignores the facts that we are all but units in a great

community, that the blessings of life and health are given us not merely for our own personal and selfish enjoyment, that life and health involve duties and responsibilities, and that each of us has work to perform. You will perhaps better understand my meaning if I read to you the following passage from an address delivered at the inauguration of the Juries of the International Health Exhibition by Sir James Paget, one of the greatest living representatives of the medical profession. He says: "In consideration of his own self, a man may be deemed healthy who lives idly, comfortably, and long; who enjoys every day of his life, and satisfies every natural appetite without consequent distress. And when such an one dies of old age with a timely, uniform, and painless decay of every part, he may be deemed to have been completely healthy; and yet it is possible he may have enjoyed his own health in the midst of a poor, unhealthy, and unhappy nation, to which he has done no good whatever. If we could find a nation composed of people such as this man, we might be bound to speak of them as healthy; but we should be right in calling the whole nation utterly unsound, and might safely prophesy its complete stagnation or its quick decline and fall. It is not health such as this—idle, selfish, unproductive—that we want to promote either in the individual or in the multitude. Comfortable idleness, such as that of some vagrants and some fine gentlemen, is a despicable result of good health; it is what no thorough man would ever wish for. In view of the national health and welfare, the pattern healthy man is one who lives long and vigorously; who, in every part of his life, wherever and whatever it may be, does the largest amount of the best work that he can, and when he dies, leaves healthy offspring. And we may regard that as the healthiest nation which produces for the longest time, and in proportion to its population, the largest number of such men as this, and which, in proportion to its natural and accumulated resources, can show the largest amount and greatest variety of good work."

This evening I shall only direct attention to the health of the individual as an individual, and shall say nothing with regard to

the many other interesting points to which I have thus briefly alluded.

Now, in order to understand the nature of disease and the manner in which it may originate, it is essential to start with a clear notion of the more elementary points in the mechanism of the human body, and of the manner in which that mechanism acts. Let me endeavour, then, to give you such a general idea of the structure and functions of the human body as is essential for our present purpose.

Brief Sketch of the Structure and Functions of the Human Body.

The human body is a highly complex piece of animal mechanism, but if we analyse its individual parts we find that it is composed of *cells* or of structures derived from cells, *cell derivatives* as they are termed.

These cells (see fig. 1), which are too small to be seen by the naked eye, and which have to be studied by means of the microscope, are the active constituents of the human body. *The cell is in fact the organic unit.*

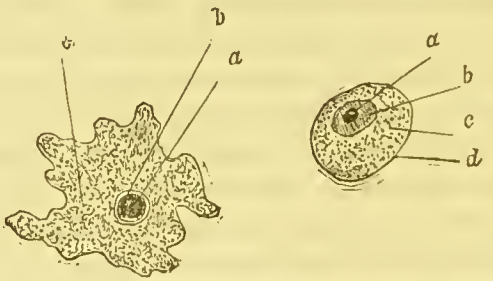


Fig. 1. The cell; it is composed of a jelly-like material called protoplasm; it is surrounded by a condensed outer coating (the cell wall, *d*); in its interior is an oval structure (the nucleus, *b*); within the nucleus is a highly refractive granule (the nucleolus, *a*); *c* = cell contents.

Fig. 2. The amœba. *a* = nucleolus; *b* = nucleus; *c* = cell body.

In some of the lower forms of animal life, such as the amœba (see fig. 2), a single cell represents the whole organism, captures nutritious particles which come in contact with it, digests them,

expels the waste products, exhibits active movements, reacts to external stimuli and produces other cells, in fact performs a variety of functions. In man the innumerable cells of which the body is composed are divided into separate masses or cell groups. Each of these cell groups or organs, as we term them, has a separate and distinct function ; the liver cells, for instance, secrete bile, the stomach cells gastric juice, the kidney cells urea, and so on ; there is, in short, in man a *division of labour* amongst the cells, which is associated with a *differentiation of structure* for the arrangement of the cells in the different organs, and in many instances the form and appearance of the cells themselves are different.

But although the different organs of the body have each their separate and distinct functions, they are all more or less mutually dependent one upon the other, and are brought into intimate connection by means of the fibres of the nervous system and by the network of blood and lymph vessels in the midst of which they lie.

In order to understand the nutrition of the whole organism and the derangements to which it is liable, it is necessary to be acquainted with the life history, so to speak, of the organic units or cells of which it is composed. I may perhaps make this part of the subject more interesting, and possibly at the same time more clear, if I make use of an illustration.

The human body may be compared to a huge organic citadel, surrounded on all sides by a marvellously constructed wall (the skin), thickly peopled in its every part by innumerable active workers (the individual units or cells), and governed by an all-powerful commander (the intelligence and the will). The individual workers are arranged in many groups, each with its special function (the different organs of the body). The commander, himself invisible and inscrutable, occupies the highest tower in the citadel. He is surrounded on all sides by an immense number of staff-officers (the nerve cells of the brain, see fig. 3). It is the duty of some of these officers to receive telegraphic messages from the different parts of the citadel and its groups of workers, and to communicate them to the commander (these

are the sensory nerve cells of the brain, the nerve cells composing the perceptive cerebral centres as we technically term them). One large group of these officers (the nerve cells composing the centres for sight) is in telegraphic communication

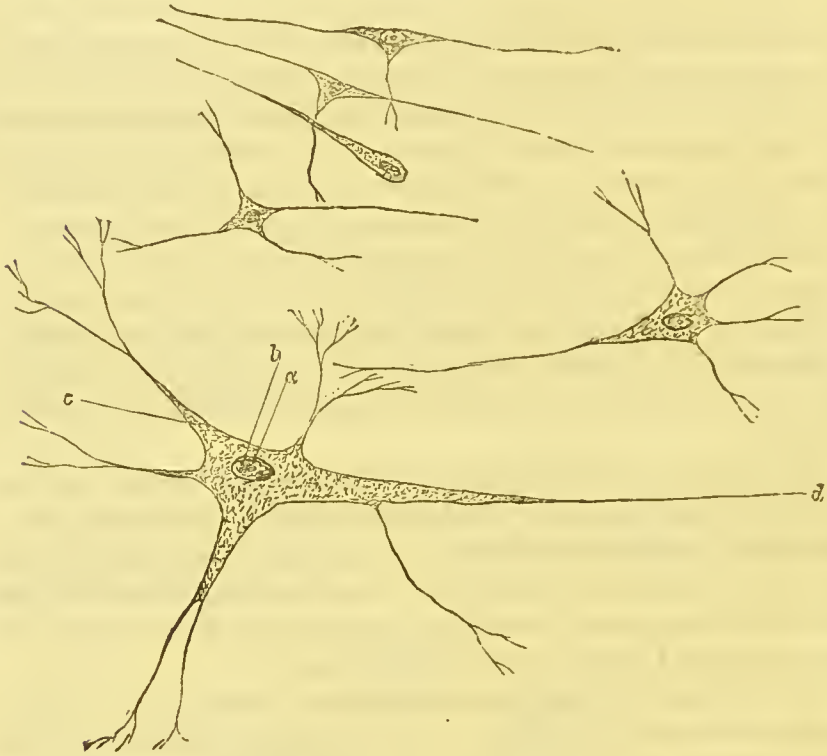


Fig. 3. Various forms of nerve cells from the brain. (After Klein.)
a = nucleolus; b = nucleus; c = cell process; d = axis cylinder process.

with two large organic telescopes (the eyes), which sweep the horizon in all directions, the connecting telegraphic wires being represented by the optic nerves; another group is in communication with two large ear trumpets (the ears); other groups with the receiving apparatuses or end-organs as they are technically termed, of taste and smell; others (the centres for touch and temperature sensations) are in communication with every part of the outer wall or skin, and are at once "wired" when anything comes in contact with it, or when it is made too hot

or too cold; others receive messages from the many groups of workers or cells distributed throughout the building. It is the function of other members of the staff (the motor nerve cells of the brain) to receive orders from the commander and to transmit telegraphic messages to the machines which maintain the citadel in the erect position, which move its different parts, propel it from place to place, capture its supplies, defend it from attack, which do its work, which express the feelings of the general, and by means of which he communicates with other citadels (the muscles of the trunk, limbs, expression, and organs of speech); other nerve cells—but these are subordinate officers, and situated at a lower level, corporals or sergeants we may term them—are less directly in communication with the general, and are constantly sending encouraging messages to the different groups of workers, stimulating them in their work (these are the so-called trophic nerves); other subordinate officials regulate the supply of nourishment which is being sent to the individual workers and organs (these are the vaso-motor nerves); others again are constantly stimulating the important machines which propel the nourishment through the body (the heart), and which move its great ærating machine (the lungs).

In such a citadel there must, of course, be arrangements for manufacturing and distributing rations to the garrison and workers, for supplying it with fresh air, for removing its waste products, for heating it, and for protecting it from external atmospheric conditions.

The food-preparing apparatus.—At one part of the wall there is a stoke hole, communicating with a large chamber (the mouth, see fig. 4), into which the raw material necessary for the preparation of the food is shovelled at the command of the governor. In this cavity the raw material is chopped up and ground down (by the teeth), and mixed with the products of the first great digestive manufactory (the salivary gland). It is then passed through a long straight tube (the gullet) into another large cavity (the stomach), where it is thoroughly mixed with the product (juice) of another most important manufactory (the

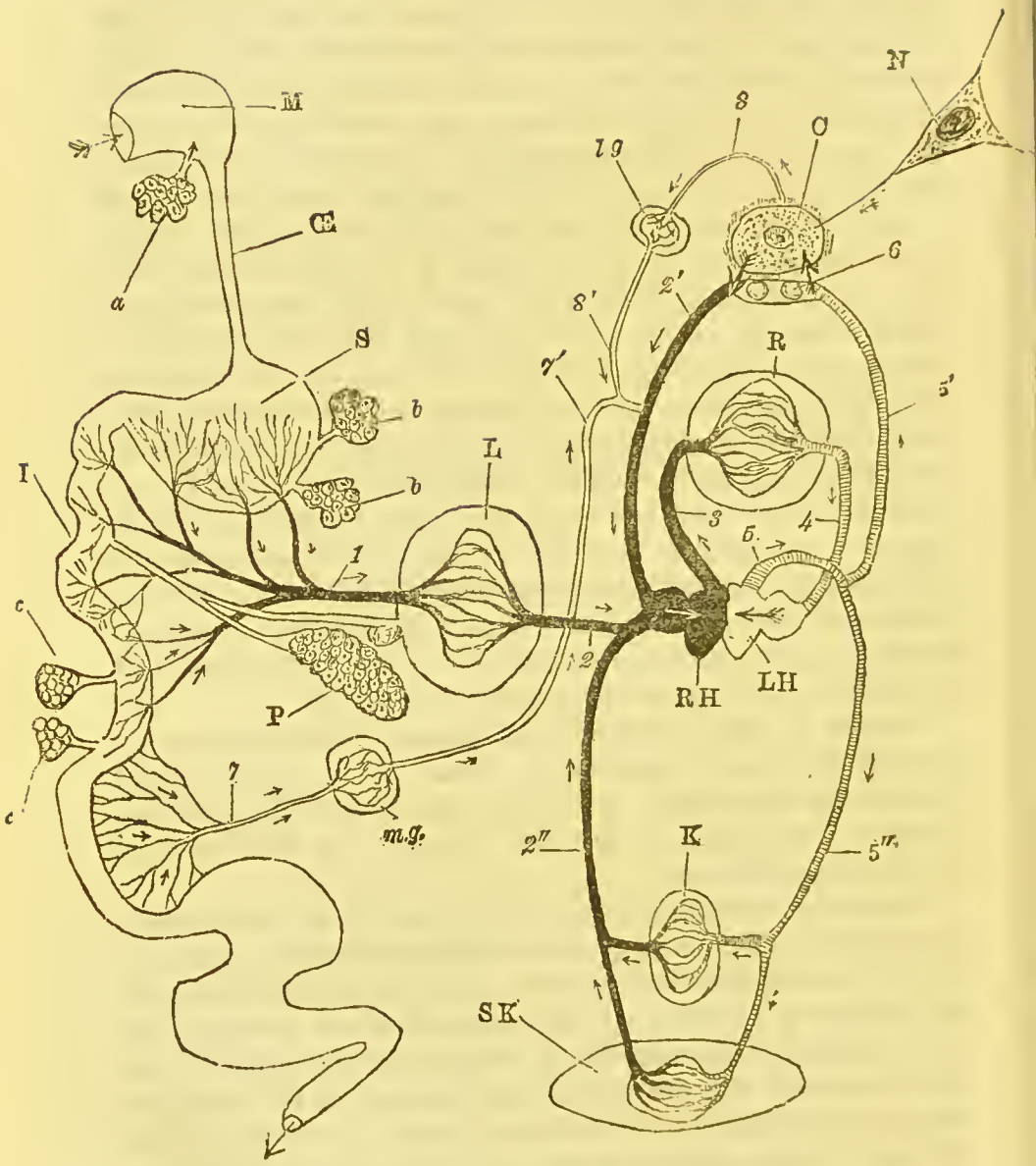


Fig. 4. Diagram of the nutrition of the body.

gastric glands); finally it is passed on to a long and tortuous chamber (the intestines), in which it is mixed with the products of other important manufactories (the liver, the pancreas, and the intestinal glands). By these various mechanical and chemical processes a food (or fluid containing nutritious matters in a state of solution or suspension) which is suitable for the nutrition of the individual organic units or cells is prepared. The refuse products are separated and passed on to the lower part of the intestinal tube, from which they are finally expelled.

The food-distributing and ærating apparatuses.—The food which has been prepared in this manner is taken up partly by a set of tubes, the blood-vessels, which ramify in all directions in the walls of the stomach and intestines; partly by another set of vessels, the lymph vessels, which have their origin in the intestinal walls. The veins pass through the large and important organ, the liver, in which the fluid food (or blood plasma) is still further elaborated; thence it is carried to the right side of the heart. That which is absorbed by the lymphatics in the walls of the intestine is also passed through a preparing manufactory (the lymphatic or mesenteric glands), and is poured into the veins and likewise carried to the right side of the heart. From the right heart the blood is pumped through the lungs, in which it absorbs large quantities of oxygen. The blood, I may explain, consists of two parts, the blood plasma and blood corpuscles, which are of two kinds, white and red (see fig. 5); the oxygen is absorbed by the red blood corpuscles or oxygen carriers, as they are termed. From the lungs the blood passes to the left side of

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DESCRIPTION OF FIG. 4.

M = mouth.
Œ = œsophagus or gullet.
S = stomach.
I = intestine.
P = pancreas.
L = liver.
a = salivary, *b*, *b* = gastric, and *c* *c* = intestinal glands.
R H = right heart.
R = lungs.
L H = left heart.
C = organic unit or cell.
N = nerve cell.
1 = portal vein.
2, 2′, 2″ = great veins proceeding to the right side of the heart.
3 = pulmonary artery.
4 = pulmonary vein.
5 = aorta.
5′, 5″ = arteries of the body.
6 = capillary vessel containing blood corpuscles.
7, 7′ = lymphatic vessels passing from the intestine.
m g = mesenteric gland.
8, 8′ = lymphatic vessels of tissues
l g = lymphatic gland.
K = kidneys.
Sk = skin.

the heart, by which it is pumped through the arteries into the delicate thin-walled capillary vessels which pass in all directions through the different organs, and which lie in close contact with the individual organic units or cells (see fig. 6).

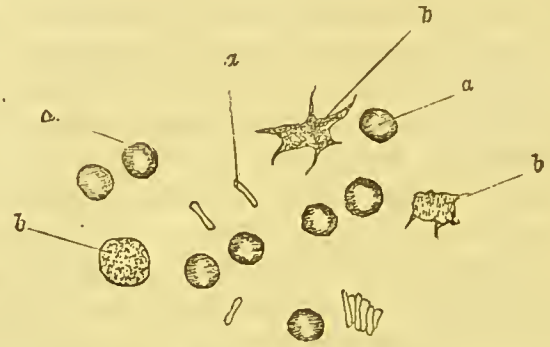


Fig. 5. Blood corpuscles, magnified.
a, *a* = red blood discs; *a'*, the same seen sideways; *b*, *b*, *b* = white blood corpuscles.

The changes which take place between the blood and the individual organic units or cells.—Each cell may be regarded as a small chemical laboratory, under the direction of the vital force which

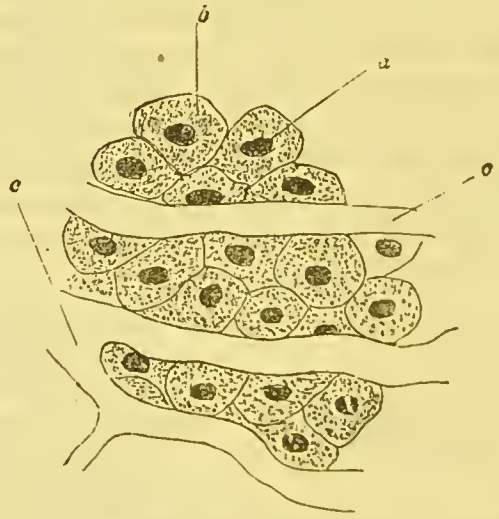


Fig. 6. Liver cells and capillary blood-vessels. (After Klein.)
a = nucleus; *b* = cell body; *c*, *c* = capillaries.

is inherent in every living tissue. Under the direction of this vital force each of these little laboratories abstracts the materials which it requires for its own nutrition and special work, from the blood plasma, and oxygen, from the red blood corpuscles. The nutrient materials are split up and rearranged, and the waste products are discharged and carried away in the manner I shall presently describe. Some of the cells simply abstract materials for their own nutrition; others, such as the fat cells, store up materials within themselves; others manufacture or secrete new products, such as the bile and gastric juice; others excrete or separate the waste products, such as urea and sweat; others again, such as the nerve and muscle cells, store up force which is set free or discharged under the command of the will. Such are the arrangements by which the blood plasma or food of the garrison (the cells) is manufactured and distributed. Let us now consider the arrangements by which the surplus and waste products are got rid of.

Arrangements for the removal of the waste products.—The waste products which result from the chemical changes within the cell are restored to the blood. Carbonic acid is one of the most important of these products; it is discharged into the capillaries and removed by the veins. The other waste products, which vary with the nature and function, we may suppose, of the individual cell, are partly removed by the same means, *i.e.*, absorbed by the capillaries and carried away by the veins; partly by another set of vessels, the lymphatics, which drain away the surplus blood plasma, which has, as it were, been used by the cell, and which has not again been absorbed by the capillaries. These lymphatic drains ultimately discharge their contents into the veins (see fig. 4).

From this description it will be seen that there is a constant interchange of material between the blood and the tissues, each cell abstracting materials from and returning materials to the bath of blood plasma, so to speak, in which it lies. It is obvious, therefore, that each individual cell must modify to some extent, however small, the composition of the blood; it will readily, therefore, be perceived that each tissue and organ materially modifies the composition of the blood and exerts an influence upon the nutrition of the whole body.

Arrangements for the purification of the blood.—The great scavengers or purifiers of the citadel are (1) the kidneys, whose special function it is to separate and discharge the waste nitrogenous products in the form of urea and other compounds; (2) the lungs, which are the chief discharges of carbonic acid; and (3) the skin, whose great function it is to separate and discharge water in the form of sweat.

Water is also discharged by the kidneys and by the lungs; carbonic acid by the skin; animal matters are also given off in the breath; and in disease, at all events, urea may be discharged by the sweat glands, but to this interchange of function between the three great excretory organs or scavengers of the blood I need not further refer.

The heating apparatus.—The heat of the body is chiefly produced by the chemical changes which are constantly taking place in the cells, more especially in the liver cells and muscles. Heat is being constantly lost by radiation from the surface, in heating the expired air, by the driving off of moisture from the skin and lungs, and in warming the discharged products (urine and fœces). The balance between the production and loss is regulated by a beautiful nervous mechanism which it would be out of place to attempt to describe here.

Such is a brief sketch of the more important points which it is necessary to be acquainted with in order to understand the derangements of nutrition. I have said nothing, you will observe, of the perfection of these arrangements, but I may remark, in passing, that the more one knows of the structure and functions of the human body the more one must admire its marvellous beauty. It matters not whether you look with high powers of the microscope at these little cells, whether you regard the wonderful mechanism by which the different parts are brought into relationship, whether you look at the perfect manner in which the different organs and parts are packed for protection and for economy of space, or whether you look at the finished whole as you see it, for example, in the person of a little child, a lovely girl, or in the god-like countenance of an intelligent and intellectual man or

woman, from whatever point of view you regard it you cannot but be lost in respectful admiration at the singular beauty of the completed whole, and at the absolute perfection of its every individual part.

Now let us turn to the pathological side of the picture and try to understand the manner in which derangement, disease, and death may arise in this citadel or in its different parts

Derangements of Nutrition.

Derangements of the nutrition of the garrison may be due to a variety of causes, amongst which the following are some of the chief:—

Firstly, An insufficient supply of rations.—This of course might depend upon the fact that the citadel was placed in such a barren country that supplies could not be procured; or upon the circumstance that the commander was too stupid or too lazy to make the necessary exertions to capture supplies; or upon incapacity or derangement of the digestive manufactories. It is unnecessary to insist upon the immense influence which disease of the digestive organs necessarily exerts upon the nutrition of the whole body, and it would be out of place for me to go into details. I shall, however, presently point out some of the causes of deranged digestion and the ways in which they may be prevented. Again, there may be plenty of raw material (food), it may be properly prepared by the digestive organs, but owing to incapacity or disease on the part of those whose duty it is to distribute it (the prepared food or blood plasma), the nutrition of the garrison or of some part of the garrison may suffer. Malnutrition, the result of disease of the heart or blood-vessels, is common. We find, for instance, that as the body grows old the arteries are apt to become degenerated or diseased, and it sometimes happens that the channel of an artery becomes completely obstructed and the supply of nourishment completely shut off from some part of the body; local death of the part may then result; gangrene or death of the foot and leg is not unfrequently

produced in this manner in old people. Then, again, it often happens that a little clot of blood which has formed at some part of the circulation, say, for example, on a valve of the heart, becomes detached and carried by the blood to some distant vessel, in which it sticks, obstructing the blood channel and shutting off the supply of nourishment from some part of the body. The results which follow depend upon the function of the part which is thus deprived of its nourishment; when, for instance, the artery supplying the group of nerve cells comprising one of these so-called motor centres in the brain is obstructed, the nerve cells die, the will can no longer influence the muscles which are put into action by those nerve cells, and paralysis or loss of motor power in those muscles results. I may perhaps take this opportunity of alluding to another way in which local destruction of a part may be produced, though it does not exactly occur in the present connection. It occasionally happens that one of these little arteries bursts, and blood is poured out into the surrounding tissues. You can readily understand that when this occurs in the midst of a delicate and important tissue, such, for instance, as the brain, very serious results must necessarily follow. You will better appreciate the importance of this accident if you compare each of the nerve cells of the brain to a small electric battery, and each nerve tube to a conducting telegraphic wire, the director or guider of all the batteries being the intelligence and the will. Now realise if you can that there are calculated to be 1,200,000,000 of these nerve cells or batteries, and 4,800,000,000 of these connecting wires, all condensed into the small compass of the human brain, and you can imagine the tremendous effect which will necessarily be produced by a very small extravasation of blood into their midst. Many of the batteries may be at once discharged, in other words, a convulsion may be produced; a tremendous shock will be communicated to the commander (the intelligence and the will), insensibility will in fact probably be produced; the after effects will be very serious, for the communications from the surface of the body will be more or less interfered with, and the commands of the general (the will) will no longer be transmitted outwards; in other words,

sensory and motor paralysis will be produced. The two conditions which I have just mentioned (sudden plugging of a blood-vessel of the brain by a clot detached from the heart, and rupture of an artery in the brain,) are, in fact, the causes of the condition which you all know under the name of apoplexy.

Disease of an artery only interferes with the supply of nourishment to a limited part of the body, but disease of the heart may interfere with the nutrition of the whole body.

Secondly, An over-supply of rations.—Over-eating is a common cause of derangement of the digestive functions and sometimes of disease. It must be remembered that anything over and above the quantity of nutriment which is required to replace the waste which is constantly going on in the body is not only unnecessary but is apt to do harm, and that in several ways. Every organ benefits by a certain amount of work, but if the exercise of its functions is excessive it becomes exhausted and is apt to become diseased. Over-work of the stomach or other parts of the digestive apparatus is a common cause of dyspepsia. Again, if too much food is supplied to the body, and more particularly if it is too rich in quality—but to this point I afterwards will more particularly allude—the blood becomes as it were over-saturated with nutritious materials, with the result that those organs which have to depurate or purify the blood are over-worked and are apt to become exhausted, irritated, and diseased. As a matter of fact we find that derangements of the liver and kidneys, gout, dyspepsia, and other conditions, to which I need not particularly refer, are sometimes produced in this manner.

Thirdly, Inappropriate rations.—Derangement and disease of the garrison might be produced by the fact that the raw material (or food) was not suitable for the manufacture of appropriate nutriment, or that some deleterious material was contained in the food. Both of these conditions, but more especially the latter, are frequent causes of actual disease. When, for instance, fresh vegetables, or some substitute for fresh vegetables, are omitted from the dietary, scurvy is apt to be produced. The outbreak of scurvy has been the cause of failure of many of our Arctic expedi-

tions. The affection is comparatively rare in this country, but it is every now and again met with. I have known it not infrequently produced amongst poor people, who had been obliged to live for some time on bread and tea. Many substances might be mentioned which are taken with the food, and which are apt to cause irritation, derangement, or disease. Amongst those the most common is, perhaps, alcohol. In considering the subject, I may at once say that I am not a total abstainer, and that the position which I take up in regard to this matter is very much that of Sir Andrew Clark. In a lecture which he recently delivered in London, and which you have probably seen noticed in the papers, he stated amongst other things that so far as is at present known, a small, or as it has been termed, a physiological quantity of alcohol does not produce disease in the healthy adult. I say the adult, for it is more likely to produce disease in the young growing organism. There can, however, be no doubt that alcohol is quite unnecessary for healthy persons. It is one of those substances, such as tobacco, which we term luxuries. Many articles of food are luxuries, in fact, few if any persons unless under compulsion restrict themselves simply to the amount of plain fare which is necessary for health. If alcohol is taken as a luxury, it should be well diluted and taken along with food. In health, then, alcohol is unnecessary, but it does not, so far as is at present known, when taken by the adult in small and suitable quantities, and at proper times, produce disease. But further, there are many persons doing good work in the world who are not quite healthy, and to some of them alcohol is distinctly beneficial. I am speaking, you will observe, of the use and not of the abuse of alcohol. I now pass to the abuse, and I would most strongly urge you to remember that any excess is most injurious. No one can have practiced medicine for any length of time without becoming convinced of the fact that a whole host of diseases—to say nothing of accidents and crimes—are due to over-indulgence in alcoholic liquors; and it would be very much better for mankind, as a whole, if they cannot restrict themselves to the purely and strictly moderate use, that they should not

take any alcohol at all. When taken in excess, but as small quantities spread over a long time, alcohol acts more especially on those organs with which it comes in contact,—on the stomach, on the liver through which it passes in order to reach the general circulation, and on the kidneys; but the nervous system, and in fact every organ and tissue, is more or less affected by it. When taken in large quantities it acts more especially as a poison to the brain, and may, as you doubtless all know, produce not only insensibility but even death. I need not specify in detail the many different affections and diseases (such, for example, as delirium tremens, convulsions, "gin-drinker's liver," Bright's disease of the kidneys, &c.), which may be caused by it. But not only does excess in alcohol produce distinct and well marked disease, but it lowers the whole tone of the system, and prevents recovery in many acute and chronic affections. There is, for example, no fact better established than this, that persons who have been given to alcoholic excess almost invariably succumb to an attack of cholera. Again, as I have elsewhere pointed out, the habitual over use of alcohol robs us doctors of one of our most important means of treating disease. In fevers and some forms of heart disease, for example, alcohol is a most valuable remedy; persons who have taken alcohol habitually in excess do not respond or react to the stimulating action of the drug, and in some cases this makes all the difference whether the patient will die or will recover.

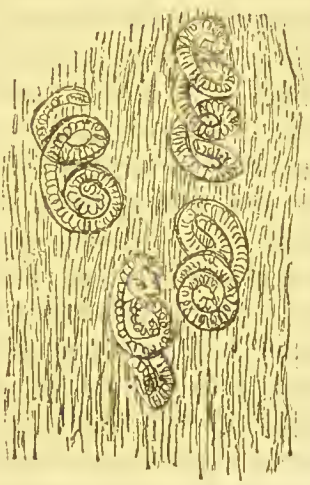


Fig. 7. Section of muscle showing the trichina spiralis *in situ*. Magnified.

I may here perhaps also allude to the influence which the proper cooking and preparation of the food exercises. There is, for example, a disease called trichinosis, in which the muscles

become filled with little living organisms, small worm-like bodies, (see fig. 7); the condition which is comparatively rare in this country, but common in certain parts of Germany, is produced by eating badly cooked pork. The parasite infests the pig, and in some parts of America a large proportion of the pigs are affected by it. The living organism in the pork can fortunately be killed by a sufficient amount of heat. The pork should not only be roasted,—for when roasted a crust or hard coating is apt to be formed on the outside of the joint and the organisms in the inner parts of the mass to be unkilled,—but should be first thoroughly boiled and then roasted. The preliminary boiling does not, as you might suppose, spoil the dish; in fact, to my taste, it improves it.

I have thus briefly alluded to some of the more important derangements of nutrition which are produced by an insufficient or injurious dietary. I must now briefly mention some of the derangements which are due to a deficiency of oxygen.

Derangements due to an insufficient supply of oxygen. — The organic unit or cell requires, as we have seen, a sufficient supply of oxygen both for its own nutrition and for its work. When the living body is suddenly deprived of all oxygen death from asphyxia, as we term it, results. Examples of this form of death are seen in drowning and strangulation. "But the deprivation of oxygen and the accumulation of carbonic acid cause injury long before the asphyxiating point is reached. Uneasiness and headache arise when less than one per cent. of the oxygen of the air is replaced by other matters; while the persistent breathing of such air tends to lower all kinds of vital energy, and predisposes to disease." Even a very small diminution in the necessary supply of oxygen to the individual tissues—a result which occurs in anæmia, in which condition the red blood corpuscles or oxygen carriers are deficient—leads to disease. Fatty degeneration, as we term it, of the heart and other tissues may be produced in this manner. From these considerations you will at once perceive the immense importance of proper ventilation. Time does not permit me to go into details on this point; probably most of

you are already familiar with the subject, for many of you no doubt enjoyed Professor Maclagan's lecture on the subject. I must, however, emphasize the very great importance of attention to ventilation, not only during the day but also during the night. After dark the gas, which most of us use as our source of light, consumes a large portion of the necessary oxygen, and in addition pollutes the atmosphere by discharging into it the waste products of combustion. During sleep we pass a large portion of the twenty-four hours in one room; it is very necessary therefore that our sleeping apartments should be of sufficient size and well ventilated. I may mention in this connection that every adult person ought to have at least 800 feet of cubic space to himself, and that space must not be a hermetically sealed chamber, but must have free access, either direct or indirect, with the external air. A cubic room 9 feet high, wide, and long, only contains 729 cubic feet of air. You will now perceive the immense advantage of a large bedroom. Further, the greatest care must be taken to prevent noxious substances getting into the atmosphere which we are in the habit of breathing. The escape of foul air from drain pipes is, as you all know, very poisonous. The escape of coal or common gas is also very prejudicial. Badly made common gas contains 20 or 30 per cent. of carbonic oxide, a substance which acts as a deadly poison by taking the place of the health-giving oxygen in the red blood corpuscles, and forming a compound with a substance called hæmoglobin which they contain; this compound of carbonic oxide and hæmoglobin is with difficulty decomposed by oxygen. If, therefore, a large portion of the red blood globules are occupied by carbonic oxide, and thus rendered useless as oxygen carriers, the animal may die from asphyxia. The slightest escape, therefore, of common gas into a room or house should be at once attended to and rectified. I might mention many ways in which the tissues may be deprived of their full supply of oxygen, such, for instance, as disease of the lungs, diminution in the number of red blood corpuscles, defects in the heart and other organs of circulation which propel these red blood corpuscles or oxygen.

carriers through the body. I cannot go into details. I may, however, take this opportunity of alluding very briefly to the immense importance of a sufficient amount of muscular exercise.

The importance of muscular exercise.—The contraction of the muscles materially aids the blood flow in the veins, and the flow of lymph in the lymphatic vessels. During muscular exercise the action of the heart and lungs is increased in frequency; more oxygen is absorbed by the blood; more oxygen is pumped through the tissues; the stagnant corners of the circulation are, as it were, washed out and purified, for oxygen is a great burner up and purifier of waste products; the circulation through the kidneys and skin, and the excretions from these important scavengers, are increased; the greatly increased consumption of nutrient materials which takes place during active muscular contraction demands an increased supply of nourishment, the appetite is consequently increased; the increased flow of highly oxygenated blood through the nerve centres produces a stimulating and invigorating effect on the whole body; and lastly, there is a greatly increased production of animal heat. In all of these ways muscular exercise proves most salutary.

Derangements due to defective removal of the waste products from the body.—This is a subject of the greatest practical importance, for many diseased conditions arise from defective removal of the waste products.

When, for example, the waste products, which are not required for nutrition, are allowed to accumulate in the alimentary canal, the process of digestion is apt to become deranged, and dyspepsia produced, a foul tongue, headache, and the group of symptoms which are commonly termed biliousness, are frequently due to this cause; foul gases are absorbed into the blood from the intestine, the blood is rendered impure, and the nutrition of all the tissues is apt to suffer. Then, again, when the action of the kidneys is defective, urea and other compounds, which ought to be excreted by the kidney, are retained in the blood. The most injurious results, and even death itself, may be due to this cause. It is of the greatest importance, therefore, to attend to the condition of

these scavengers, and to avoid all conditions which are likely to derange their action. Over-eating, more especially too much nitrogenous food, the waste products of which are excreted chiefly by the kidneys, is to be avoided. Alcohol in excess also irritates and ultimately may produce disease of the kidneys; and there are many other substances which may act in the same manner. Persons, for example, who have been for a long time exposed to the action of lead, such as workers in white lead factories, plumbers, and painters, sometimes suffer from disease of the kidneys produced by the irritation of the lead which they (the kidneys) discharge from the body. Defective action of the skin is also apt to be followed by injurious consequences. The skin is one of the great channels through which water is expelled from the body; carbonic acid gas is also given off from the skin, and in conditions of disease, at all events, urea is sometimes excreted in the sweat. Then, again, the skin is the chief means by which heat is given off from the body. It is of the utmost importance, therefore, to attend to cleanliness and to keep the skin in a healthy active condition. This is more especially the case when the action of the kidneys is defective, for under such circumstances the function of the kidneys is partly carried on by the skin. Then, again, if the action of the skin is allowed to become defective, an increased strain is thrown upon the kidneys. Defective action of the lungs, the third great scavenger of the body, has previously been alluded to, and the importance of ventilation insisted upon. If time permits, I will afterwards refer to some diseases of the lungs which are due to the inhalation of irritating materials.

Derangements due to defective influence of the nervous system.—It is impossible to over-estimate the influence which the nervous system exercises over the nutrition of the body. This influence is exerted on every tissue and every organ, and is apparent both in health and in disease. I have likened the nervous system to a commander surrounded by his staff of officers, who are in communication with the individual organic units in the human citadel, and I may perhaps best illustrate the all-important

influence for good of this commander by comparing it to the influence which our noble and gallant countryman General Gordon has for so many months exercised over the citizens of the beseiged town Khartoum. The meanest citizen in Khartoum, though he may never himself have been in direct communication with General Gordon, has doubtless had his drooping spirits raised, and has been stimulated to renewed vigour and exertion by Gordon's influence. Now just such a healthy trophic influence is exercised by the great nervous system on all the tissues and individual organic units in the human body. Again, the nervous system affects nutrition by calling into play the functional activity of the different organs and parts. Just as we may suppose General Gordon has by repeated and regular drills raised the troops under his command to a high state of efficiency, so does the systematic use of any tissue and organ, and indeed of the brain itself, improve its working and increase its functional power. The largely developed arm of the blacksmith is a familiar example of this truth. Then again the supply of nourishment to the individual tissues and organs is under the control of a special part of the nervous system, the vaso-motor nerves as they are technically called. The nervous system, too, maintains the balance between the production and loss of animal heat; and upon the action of certain parts of the nervous system, the continued working of the heart and lungs, the organs above all others which are essential for life, depends.

From this brief statement you will see how important it is to keep the nervous system in a healthy state of nutrition, and to see that it is not exhausted by over-work or worry. It is especially important to regard the condition of the nervous system during the period of active development and growth. You may perhaps in this connection expect me to refer to that question, which is so largely at present occupying public attention, viz., over-pressure in elementary schools; but time, and I may also add, my own want of knowledge, for I have no special experience which warrants me in giving an authoritative opinion on this point, warn me that I must pass on. I must,

however, briefly refer to the all-important influence which a properly conducted system of education—and by the term education I mean the whole training of the body and mind during the period of development and growth from childhood until adult age — necessarily exercises upon the health of the body. Now it may be stated broadly that no system of education is sound which in any way interferes with the robust development of the body. It is unnecessary to insist upon the importance of robust health for those who have to work with their hands; but good health is no less essential for those who work with their heads. It is, of course, perfectly true that much good brain work is accomplished by those who are very far from healthy and strong. It cannot, however, be denied that for great success a certain measure of good health is indispensable. In these days of keen competition rapid success is comparatively rare; it is the "staying" horse which most frequently wins the race. You must remember, too, that good mental work is impossible without healthy brain structure,—the one is directly dependent upon the other. The nutrition of the brain cells is conducted in exactly the same manner as the nutrition of all the other cells in the body, and anything which interferes with the nutrition of the body necessarily interferes with the nutrition of the brain, and so impairs its function and functional products (mental work, &c.). Now the question which naturally occurs here is, Is the system of education which is at present in operation in this country calculated to produce the highest possible state of bodily as well as of mental development? There is probably little if anything to complain of in most of our great public schools for boys. It is, however, very much to be doubted whether the same thing can be affirmed of many of our best schools for girls. But on this point I have no time to enter into details. With regard to the health of children in our elementary schools, the statistics which Sir Lyon Playfair quoted in his recent address to his constituents show that there has been a lessened mortality since the present system of national education came into operation, of from 30 to 35 per cent.

amongst children of school age, and he gives good reasons for supposing that 22 per cent. of this lessened mortality is directly due to the conditions associated with our present system of national education. This result is of course satisfactory in the highest degree, but it does not show that the best possible results, which this system can afford, have been obtained; it does not show that there is no over-pressure. It must be remembered that over-pressure rarely kills. There is a wide-spread feeling amongst medical men, and it would appear also amongst many teachers, that there is a certain amount of over-pressure. There is no doubt that in the upper and middle classes the disastrous results of over-pressure are frequently met with, and, if other things were equal, we should naturally expect these disastrous results to be very much more frequent amongst the ill nourished, badly fed, badly clothed children of the lowest class. There seems, too, to be a pretty general idea that the present system of payment by results has much to do with the alleged over-pressure, and certainly to the medical mind it would appear that any system which necessitates cram and over-time work should be avoided. I do not mean to suggest that the system of examination and payment by results is itself bad, probably it is the best means of stimulating both teachers and scholars that can be devised, but it ought to be so arranged that there is no over-time, and that the results depend upon the work done in the ordinary school hours. Possibly it is difficult to avoid punishment by keeping-in. Now, if by private charity or any other means, a meal of milk and bread could be offered as a daily reward of work and diligence, you would at once offer the most powerful means of stimulating the child to work, and at the same time give it as the reward of its work the very thing which it most requires. The only objection which I see—provided that such a plan could be carried out in practice—is that it would press cruelly on children who are naturally deficient. Possibly some means of overcoming that objection might be devised.

One of the greatest objects of any properly conducted system of education is to instil into the child habits of cleanliness and

order, to teach it how to work, to call forth its reasoning and thinking powers, and to strengthen and stimulate its powers of self-control. These results are much more important than the greatest amount of fact-knowledge which can be crammed into it. Time does not permit me to enlarge upon this point, but I must briefly say that the derangements and diseases of nutrition, which we have been considering, are due chiefly to two things, viz., *want of knowledge and want of self-control.* A properly conducted system of education and training will obviously, therefore, do much to prevent many of the diseases and derangements to which I have referred.

I had hoped to have been able to speak of the necessity of a proper amount of rest and sleep, of the important tonic influence of recreation and holidays, and of the derangements which may arise from errors in clothing and fashion.

Most of the derangements which we have considered may be said to arise from causes within body—from the neglect of the elementary rules or laws of health. Each man and woman has to a very large extent the power of preventing these derangements. There are other diseases, which are due to external conditions, such for example as the introduction into the system of some of these little invisible organisms which produce the infectious fevers. Many of these affections cannot be prevented by the individual as an individual, though they can be materially controlled by the community acting as a whole. There are other causes of disease which are indirect or predisposing. Some of these are inherited, others acquired. Had time permitted I would have directed attention to these predisposing causes; I would have shown you how important it is for everyone to endeavour to realise the special affections to which he is liable. A wise general who knows the weak points in his defence takes the greatest care to guard them against attack. This is what I would have each one of you do both for yourselves and for your children. I would also have wished to have impressed all those of you who are not quite well with the most comforting assurance that even after disease has effected a lodgment and the outer line of defence is broken,

there is still hope, and that, like a brave commander, nature still in most instances holds out. It is, indeed, impossible to overestimate the importance of the fact, that though when handicapped with disease these bodies of ours may fail to reach the post which marks the average span of human life, yet they seldom fail to make a gallant struggle, and even when heavily weighted with disease they comparatively rarely break down and utterly collapse quite at the commencement of the course.

THE BATH: HOW AND WHEN TO USE IT.

By JAMES RITCHIE, M.B., M.R.C.S. Eng.

Our medical text-books tell us that hydrophobia is a somewhat rare disease, but if we consider the condition indicated by the literal etymology of the word, then I am afraid we must confess that that condition, viz., the dread of water, is not by any means uncommon.

We trust that the aggravated forms of it are rare, such, for example, as that recently pourtrayed by the great censor of our country, Mr Punch. The illustration represented a much-begrimed countenance and hands, the owner of which would have required freely to use a potsherd before the softest of waters and the most detergent of soaps would have sufficed to produce much cleansing effect. The cause was at once explained by the legend, "Two years ago I used your soap, since then I have used no other." But the minor degrees of the condition are much more common, and they are not confined to any particular age or class. When the administration of chloroform was still in the days of its infancy, a gentleman who offered himself as a subject to be experimented upon had his boots taken off and put on while under the influence of the anæsthetic. When he had recovered consciousness he would not believe that such manipulation had been accomplished. He was again chloroformed, and on this occasion both boots and stockings were removed. On awakening the visible evidences of a woeful want of the use of the bath caused him bitterly to regret his unbelief. Were we to judge of the principles of some people from their practice, we should conclude

that they believe the skin to be an ornamental covering, of which only the exposed portions should be kept clean for appearance sake.

But if some are too sparing of the use of water and soap, others go to the opposite extreme. Hydrophilists, we might call them. Their frequent ablutions would lead one to believe that they are afflicted with some stain as hard to erase as was that dreadful spot on Lady Macbeth's hand. They pay the penalty in rough skin and chapped fingers. Some pride themselves upon their breaking the ice in order to have the daily bath, or that they bathe in the sea all the year round, till cric in the neck or rheumatism in one of its many forms binds its iron fetters around them. Or they insist upon their young children being bathed in the open sea in summer, or else in cold water in the dead of winter, giving as their reason that the ancient Gauls hardened their children in the frozen floods, forgetting that in the hardening process only the hardy survived.

Now we shall be more likely to avoid these extremes, and to know both *how* and *when* to use the bath with discretion, if we understand—

1*st.* Certain facts regarding the structure to be bathed, particularly the skin.

2*nd.* The general effect of different kinds of baths upon these structures.

1*st.* The structures to be bathed, particularly the skin.—The skin presents a very large superficial area—from 12 to 18 square feet. The average may be stated at about 15 square feet. It is not simply a tough elastic wrapper for the purpose of enclosing the delicate underlying structures, and protecting them from injury and from the vicissitudes of temperature. It is that, but it is much more. It is richly endowed with *nerves*, and therefore extremely sensitive to external impressions; it is highly vascular, containing networks both of *blood-vessels* and of *lymphatics*, and it is an extensive secreting and excreting apparatus, containing many thousands of *glands* of two kinds—the sweat glands and the sebaceous glands.

Were we to remove a piece of skin, then to cut from its edge a very thin slice embracing the whole thickness of the skin, and were we to examine this slice with the aid of a microscope, we might observe an appearance such as that depicted in fig. 1.

The skin we consider to consist of two layers—the cuticle or scarf-skin, and beneath it the true skin. The deeper part of the true skin is open in its structure, containing more or less of fat. Above this it is more dense, and on the surface it is covered with little eminences called papillæ, which fit into corresponding recesses in the cuticle. The portion of the cuticle next the true skin is softer and more opaque than the outermost layer, which consists of hard flattened scales. These, when they have fulfilled their function, are cast off from the surface of the body in the form of fine scales or dust. These two layers vary in thickness in different parts of the body. They are thicker and stronger on the more exposed portions, thickest on the palms of the hands and on the soles of the feet.

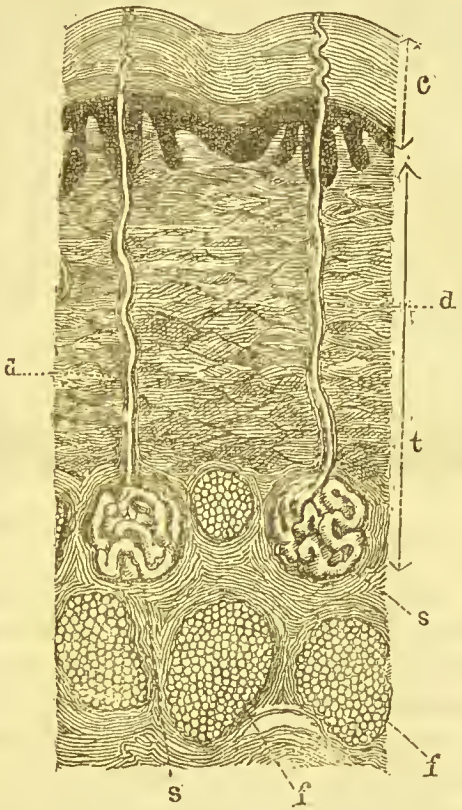


Fig. 1. Vertical section through skin of finger; (*t*) true skin; (*p*) papillæ of true skin; (*c*) cuticle or scarf-skin; (*f*) fat; (*s*) sweat glands; (*d*) duct of sweat gland.

If we use the proper means for bringing into view the *nerves* of the skin, we find that they are very numerous. They terminate in three ways specially adapted for the reception of sensory im-

pressions :—In the deeper layer of the skin by small seed-like bodies attached to the branches of the nerves, on the surface of the true skin by small bodies called touch-bodies in certain of the papillæ, (*b*), fig. 2, and lastly, by bulbous swellings in the cuticle.

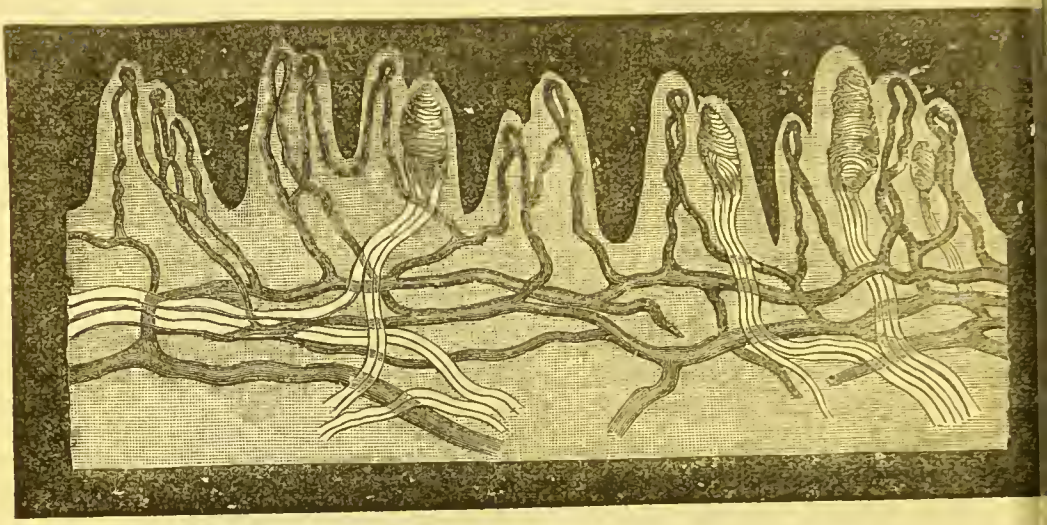


Fig. 2. Diagram of papillæ of true skin showing loops of the blood-vessels; touch-bodies or nerve endings; and nerves.

By being placed in the papillæ, these touch-bodies are under more favourable conditions for the reception of certain kinds of impressions than if they were imbedded in a flat surface. Impressions made upon the surface are, by means of these terminations, and the nerves, rapidly conducted to the spinal cord and brain. There is therefore in the skin an extensive apparatus by means of which we may soothe or stimulate either a part or the whole of the system. The sensitiveness of this apparatus you all know from the effect of heat, cold, and various kinds of stimuli, not the least memorable of which, perhaps, is that stimulus to application to study inflicted by the schoolmaster at his discretion.

Of *blood-vessels* there are extensive networks both in the superficial and in the deeper parts of the true skin, those of the superficial layer sending loops into many of the papillæ (*a*), fig. 2, thus

bringing close to the surface of the body a great extent of blood-vessels, just as in mountainous Scotland there is a much greater superficial area for streams and water-courses than if our country were a level plain.

There are also networks of vessels surrounding the glands and hair roots. The blood-vessels are not equally full at all times. They contract under the influence of cold, and dilate when heat or irritants are applied. They are still further emptied of their contents when they are constricted in consequence of contractions of the involuntary muscular fibres in the true skin. The effect of nervous influence also upon them is great. The flush of shame, the pallor of fear are caused by opposite conditions of these vessels effected directly through the nervous system. As fluids are very good conductors of heat, we have in such an extensive system of blood-vessels, so near the surface and communicating with all parts of the body, a ready channel for applying heat to, or of abstracting it from the system.

There is another extensive system of vessels--the *lymphatics*. These accompany the blood-vessels more or less closely. The latter convey to the skin the requisite nourishment, but the lymphatics are associated with them in conveying from it waste material produced in the performance of its functions. If the skin is healthy the waste products are normal, but if the functions of the skin are interfered with, these products may be morbid, and sometimes are hurtful to the system.

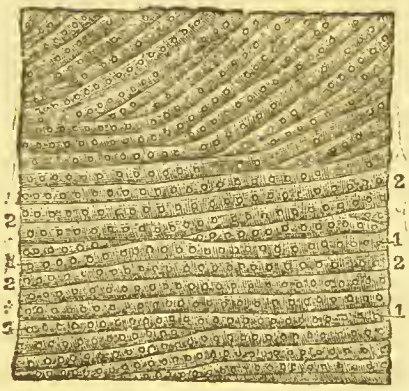


Fig. 3. Magnified view of the point of one of the fingers showing ridges and furrows. The round spots are the openings of sweat glands.

If with an ordinary pocket lens we examine the point of one of the fingers we may observe on the ridges of the skin a number of small dark spots (fig. 3).

These are the orifices of the sweat glands. With the unaided

eye we may, in warm weather, see the points of the fingers studded with minute drops of sweat proceeding from these orifices. The glands are situated in the deeper part of the true skin, (*s*), fig. 1. They communicate with the surface by means of small tubes or ducts. Were these tubes placed end to end they would extend miles in length. As they pass through the scarf-skin the ducts are twisted like a cork-screw, and at this part the walls of the ducts have no special limiting membrane, but are formed by the cells of the scarf-skin. The sweat may thus be easily diffused through the scarf-skin. It is estimated that in a square inch on the palms of the hands there are about 2800 of these glands, on the back in the same area 400. Scattered over the whole surface of the body there are upwards of two millions of them. Their function is to discharge from the body a quantity of water and organic matter. They are not at all times equally active. Under certain conditions, such as excitement, exposure to great heat, &c., they secrete the sweat very abundantly. There is constantly a certain amount being secreted. Under ordinary circumstances this passes into the cells of the cuticle, and thence from the surface, and is called "insensible perspiration." The amount in twenty-four hours is from 2 to 4 lbs. Although we are not ordinarily aware of its existence we become conscious of its absence by the dry harsh skin when the function of these glands is in abeyance, as during feverish conditions. It is the existence of this copious insensible perspiration which makes it so unhealthy to wear constantly any kind of waterproof clothing. Such clothing is useful in heavy showers, but ought not to be worn constantly. This evaporation from the skin plays a very important part in regulating the temperature of the body, and in maintaining it, even under very different and varying conditions, at a constant point, viz., about 98·4. Of the whole heat given off by the body about 77·5 per cent is lost by the skin.

The *sebaceous* glands (*l*), fig. 4, are also very numerous; they are found wherever there are hairs, viz., over the whole surface except the palms of the hands and the soles of the feet. They

are minute sacs, usually several in connection with each hair, and they open close to where the hair comes to the surface. Their function is to secrete an oily fluid in order that the skin and hair may be kept soft and pliable.

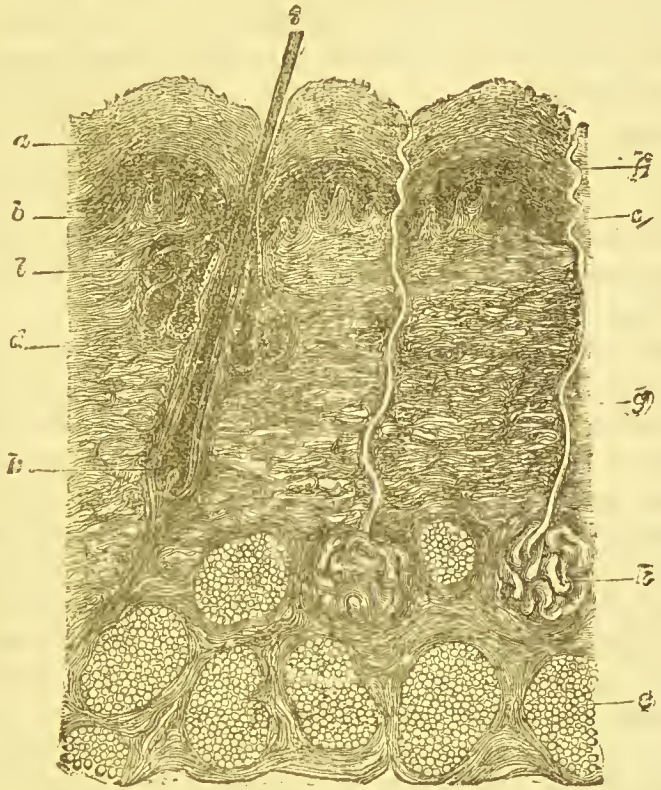


Fig. 4. Section perpendicularly through the healthy skin. (*a*) Epidermis or cuticle; (*b*) mucous layer, with pigment; (*c*) finger-like projections of true skin; (*d*) true skin; (*e*) fatty masses; (*f g h*) sweet gland and tube or duct; (*i k*) hair, with its follicle and papilla; (*l*) sebaceous gland attached to hair follicle.

The human body is a very wonderful chemical laboratory, in which even waste products are made to do useful work, but if these secretions which are also excretions are pent up in the body instead of being allowed freely to escape, the blood and the system become more or less loaded with some deleterious material, in consequence of which the health suffers. We are told that if an animal have the surface of the skin varnished it soon dies. At the coronation of Pope Leo X., a child in order that it might

represent an angel was coated with gum and covered with gold leaf. The poor child did duty at the coronation, but after a few hours it died; the symptoms were those of blood-poisoning.

The skin is thus a most important structure. A tough wrapper enclosing subjacent structures and protecting them from injury and from changes of temperature, presenting a great expansion of nerve-endings by which the system may be stimulated or soothed, maintaining the temperature of the body at a nearly constant point, associated with other organs, specially the kidneys and lungs as Dr Bramwell recently told you, in excreting from the system water, carbonic acid, and organic matter, and possessing an extensive glandular apparatus for preserving its own elasticity and softness.

In the ordinary performance of its function, the skin is continually shedding worn-out scales of scarf-skin—there are also accumulating on the surface the solid refuse of the sweat, and the secretion of the sebaceous glands. To these waste products are added the smoke, dust, and other impurities of the atmosphere, which are tolerably copious in all large towns. If these are not removed, the cells decompose, the sweat sours, the oil becomes rancid, the orifices of the glands may be blocked up, the function of the skin is interfered with, the general health suffers, an increased amount of work is thrown upon other organs, and locally the skin may become inflamed, especially where two surfaces are in contact, and have blotches on it. The artisan who works hard, perspires freely, and changes his underclothing regularly, really suffers less from want of the bath than do those engaged in sedentary occupations, because by copious perspirations his sweat ducts are flushed and the skin more or less cleansed by the friction of the clothing.

2nd. The general effects of the different kinds of baths.—These are, in ordinary health, mainly of three kinds. Cleansing, stimulating, and soothing. Perhaps the most important is the cleansing of the skin. The cleansing effect is best attained by the use of tepid or of warm water with soap.

The kind of soap.—Unless in special cases *soft soap* is too caustic

and irritating. A good quality of yellow soap can be borne by most skins. White Castille soap, white curd soap, are both good. Transparent soaps are usually pure and not irritating. Sanitas soap is good and agreeable. Dark coloured and highly scented soaps, except those of the best makers, ought to be avoided, because colouring matter and perfume are frequently added to hide the inferior nature of the material used. Red and violet soaps are occasionally coloured with deleterious pigments. Low-priced soaps are not necessarily cheap, often the reverse; they are often made from very objectionable materials, are adulterated, and contain an excess of water.

The amount of soap to be used, and the frequency of its use, ought to be regulated by the character of the skin and the kind of exposure. Greasy skins and dirty work require a more liberal allowance of it than the converse conditions. To harsh dry skins it should be used sparingly, seeing that the oil of the skin is already too scanty. Some irritable skins resent the use of any kind of soap. For applying soap the hands are better than a sponge; they adapt themselves more perfectly to irregularities of surface. In all cases the soap ought to be washed off with a copious supply of water. Some persons have a superstitious, or perhaps it should be called, a traditional, dread of washing certain parts of the body, such as the opening of the head in young children, or of using soap to the face, &c. For these fancies there is no good reason; it is as necessary to keep one part of the skin clean as another. The feet should be as daintily clean as hands or face.

THE COLD BATH.—Immersion in cold water produces more or less of shock to the nervous system, as evidenced by the gasping breathing and the tremor of the muscles. The blood-vessels on the surface contract, the blood is driven to the deeper organs—the temperature of the surface is lowered, but that of internal parts is elevated. If the bather is of good constitution and in good health, and if the immersion be of short duration, on leaving the bath reaction quickly takes place. The blood-vessels in the skin dilate in excess of their former condition, the dilatation being

usually aided by the friction used in drying. The blood having gained an accession of heat in the deeper organs, flows from them to the skin, and its temperature is comparatively raised.

The effect of such a bath, if taken with proper care, is a pleasant glow over the surface so soon as the reaction has taken place, and a feeling of exhilaration. The glands in common with all the other structures of the skin are stimulated to perform their functions more briskly, and a healthy tone is imparted to the whole system. The circulation is quickened, the respiration deepened, the digestion and nutrition are improved, there is an increased production of heat, and the nervous system is braced. The body also becomes more accustomed to variations of temperature, so that those who attend to the daily bath are much less liable to catch cold than those who do not indulge in this luxury.

The colder the water the greater the stimulating effect, provided the warm reaction is thoroughly established and persists. Excessive stimulation must, however, be guarded against. When, even although the reaction has been good, the bath is followed by languor and inability for work, the stimulation has been too great for the nervous system, that is to say the bath has been too cold.

If the bath have not been properly taken, if it have been too cold for the bather, or if the immersion have been too long, the effect may be very different. The reaction may be imperfect or wanting, and congestions of internal organs may persist, the temperature may continue lowered, and the whole vital functions be depressed. If the bath be very cold and the constitution feeble, the shock may be so great as even to be fatal.

What we aim at in taking a cold bath is to stimulate the skin, and through it all the functions of the body. Unless a good glow is produced the bath is useless or worse, and a good wash in warm water with soap would be much better.

Tepid and Cool Baths produce the same kind of effects as the cold bath, but less in degree.

The Warm Bath.—When moderate heat is applied to the surface of the body the nervous system is soothed, the vessels of

the skin relax, there is an increased flow of blood to it, the action of its glands is increased, the functions of the skin are *assisted*, and the general circulation is slightly increased. The flow to the skin may draw so much blood from the brain as even to cause faintness.

When the temperature of the bath is higher the circulation is more quickened, the breathing becomes more rapid, interrupted by frequent deep inspirations, and perspiration is copious.

Should the bath be very hot there is a powerful stimulation both of vascular and nervous systems, and in infants even convulsions may be induced.

On leaving the warm bath the capillaries of the skin contract, and the heat of the surface is lowered, the vessels remain for a time in a state of atony, and unless care is taken a chill may follow, with the unfavourable results described to you by Dr Affleck.

The general effect of a moderately warm bath is sedative to the nervous system and moderately stimulant to the circulation. But if the temperature of the body be raised, as in feverish conditions, and the nervous and circulatory systems be in a state of excitement, then the warm bath, by abstracting heat from the body, is very soothing. The stimulant effect of a warm bath is proportionate to the heat. Hot baths frequently repeated are enervating.

Delicate and wearied persons are very sensitive to variations of heat in different parts of the body. The warm bath, by causing an equable temperature throughout, soothes such a delicate or wearied organization.

A healthy person, specially one who has not much exercise, is stimulated by the use of the cold bath, but if he be fatigued, his muscles tired, stiff, and painful, he will derive most benefit from a warm bath. Cold refreshes by *stimulating* the functions, heat by *facilitating* them.

SEA-BATHING.—Cold salt-water baths have the same general effect as the cold bath, but in virtue of the contained salt they are more stimulating, and as the sea is in constant motion, it is

more stimulating than a bath in still water of equal temperature. There are also certain salutary adjuncts to sea-bathing which play a most important part in producing the favourable result. These are fresh air, change of scene, and, to most bathers, relaxation from business cares.

Warm salt-water baths are more stimulating than ordinary warm baths, consequently, by the use of warm salt water, the same amount of stimulation may be obtained as by a fresh-water bath of lower temperature.

RUSSIAN AND TURKISH BATHS are combinations of the hot and cold bath. The effect is the same, namely, to stimulate the functions of the skin, causing copious perspiration, with the removal of impurities from the surface, and to brace it up afterwards by the use of cold affusion. The RUSSIAN is a hot vapour bath, after which the Russians used to rush out and roll themselves in the snow. We are satisfied with the cold douche instead, perhaps because our supply of snow is limited. The TURKISH is a hot-air bath. It is the same in principle as the Thermæ established in Britain 1500 years ago for the comfort of the Roman legions. The Romans adopted the idea from the Greeks, and under the Empire wherever there was a Roman colony there were baths. But the fact that they were introduced by their conquerors was a sufficient reason to our forefathers for not using them. Of late years we got the system from the Turks, who, when they took Constantinople, adopted the Roman system of baths.

Having given this short sketch of the skin and its functions in relation to the subject before us, and having noted the general effects of different kinds of baths, we will now consider *How* and *When* to use the bath.

One of the first attentions conferred upon a child is the order of the bath, and we propose to describe the ceremony in detail. Its delicate little organism will not bear rough treatment without harm, and as its power of compensation is not so good as that of the adult, slight causes elevate or lower the temperature, and it does not quickly recover its normal standard. During the few first weeks of its life the temperature of the bath should be just a

little below blood heat, 92°-98°. Before the child is undressed everything should be got in readiness. There should be a fire in the room, unless in the case of older children in warm weather. The fire ought to be sufficiently good to permit of the bathing being conducted at a distance from it, with a screen in front, on which should be hung a large soft bath towel to be in readiness. The bath ought not to be small; a basin should not be used, but a round or oval tub or bath, say of 24 to 30 inches in diameter. All the requisites for bath and dressing having been placed within the nurse's reach, and she having donned her waterproof and flannel aprons, seats herself on a low chair with the child on her knee and undresses it with the exception of the flannel binder. The child is then laid on the knee with its head over the bath. The head is washed with soap, then with a large sponge the soap should be thoroughly re-removed. After the head has been carefully dried the binder is taken off and the body soaped, then the child is gently lowered into the bath, its shoulders supported by the nurse's left hand, while with the right she washes off the soap by means of a full stream of water from the sponge. For this purpose a sponge is better than the hand, the work is more quickly accomplished—a matter of importance. The child is lifted out of the bath, the whole body enveloped in a warm soft towel, and the surface very thoroughly dried as gently and as rapidly as possible. Every fold and crease should be dusted with powder. Fuller's earth is good but unsightly; prepared starch, or starch and oxide of zinc, are also useful but tend to cake; sanitary rose powder is perhaps the best. Till the child is a few weeks old the morning and evening bath should be of the same temperature, but by-and-bye the morning bath may be cooler. For healthy children at three or four months old the temperature may be reduced to 70° or 80°. The head should be washed with rather cooler water than the rest of the body, the bath being cool at first and a little hot water added before the child is put into it.

It is impossible to state definitely any temperature which will suit all children at any given age, but the following rule may be

taken as a safe guide. The colder the bath the more invigorating its effects will be, provided the reaction is good, but if on any occasion the child is pale, blue, or even chilly after the bath, the water has been too cold and should be used warmer in future.

Some children take to the water like spaniels, others are timid, and with these considerable care may at first be required. Such children should not be frightened or forced into the bath, otherwise a permanent dread of it may be established. Occasionally by lowering the child into the water in a towel the dread may be overcome, or by placing a piece of blanket over the bath, the child may be gently immersed in the water without being at first conscious of it.

During the early years of child-life a bath should be given night and morning. The morning one as a tonic and stimulant should be cool or tepid, the evening bath as a sedative and for cleansing purposes should be warmer, and the dust of the day removed with soap before the child is put to rest.

The morning bath should be given immediately the child rises out of bed while its body is warm. It should not be allowed to play about in the nursery in its night-dress, as by so doing the body cools, and is more likely to be chilled by the bath.

The necessity for careful drying of the surface has been already noted in relation to very young children. In older children the skin ought to be well rubbed in order to aid the warm reaction. Hurry ought to be no excuse for sending off a child only half dried. The more delicate the child and the weaker its circulation, the more care ought to be observed in this respect, otherwise cold hands and feet, general discomfort, chapped skin and chilblains may be the result.

In the event of illness, specially of cold in the chest and of inflammatory affections, the morning bath should be omitted, and the evening bath given warm, or warm sponging substituted.

After the child leaves the nursery the evening bath may be discontinued, but the morning tonic bath should be taken regularly if the general health permit, and a warm cleansing bath once a week in the evening.

If I have succeeded in conveying to you correct ideas regarding the skin—its complex structure and its functions—and the influence of the daily morning tub upon the general health, it were hardly necessary to say more with the view of emphasizing the importance of continuing the habit throughout life. I might, however, remind you of the extra duty which is thrown upon the system by the artificial mode of life in the present day, and upon the nerves and vessels of the skin in consequence of sudden alterations of temperature in going from warm rooms to the open air and the reverse, in consequence of which greater care is required to preserve all these structures in a healthy condition.

The cold bath ought to be taken early in the day, because then the vital functions are most active, and the reaction is consequently more likely to be good.

Those who have not been accustomed to it must not straightway go and plunge themselves into cold water, much less to bathe in the open sea unless in very mild weather. The sensation would probably be unpleasant, and the shock too great. But those of good constitution, by gradually accustoming themselves to the use of cool water, may very quickly be able to enjoy even a perfectly cold bath. In order that the cold bath may be used with benefit, there is required a certain strength of constitution, a certain power of reaction.

It is not suitable for the weak and debilitated, specially for the very young and the aged, it should not be taken by those who suffer from internal congestions, nor should it be taken when one is much fatigued, nor during certain recurring periods of more delicate health.

Delicate people may have to content themselves with tepid sponging. To begin with, the temperature of the water may be from 85° to 95°, only a part of the body exposed at a time, and that only in a warm room. Those less delicate may begin with the water cooler, and get a very good effect by rubbing the whole body with a damp towel, then drying carefully. Cold sponging is the next step.

THE SPONGE BATH may be used when the system has become

somewhat accustomed to the shock of cool water. This is the kind of bath most likely to be serviceable to the majority of people of average constitution in our climate during the winter months. The bather stands in a large flat bath or tub containing a small quantity of water, and with a sponge he causes a stream of water to flow over the shoulders and down the body. By this means it is possible to obtain very decided stimulation. Those with weak circulation, and a tendency to chilly feet, should have warm water in the bath. The body may first be washed with this, then cool or cold water, contained in a basin previously placed ready for the purpose, may be dashed over the body with a sponge. This is a very good way of giving a cold bath to children. Those who have a shower-bath, and who have not a good power of reaction, should first take a tepid bath, or warm shower, and then brace themselves with a few seconds of the cold shower.

THE NEEDLE BATH is well adapted for those who are not robust, but unfortunately it is rarely to be had except in Hydropathics. The bather enters a small circular cabinet, surrounded on all sides by vertical and horizontal pipes, from which thousands of minute jets of water are thrown upon the body with considerable force. When this bath is taken warm, followed by a short time of cold, the reaction is very satisfactory and the bather is warm and invigorated.

For the majority of people in our climate water from 50° to 70° is cold enough, but it is impossible to fix any temperature as suitable for a cold or tepid bath for everyone. The rule already given for children applies equally to adults. The colder the bath the more stimulating it is, provided the reaction takes place and persists; but should the bather be chilly or languid afterwards, then it has been too cold for that individual, or too long time has been spent in it.

Those persons who have very limited accommodation need not deny themselves the ath on account of want of privacy. By attaching loops to the adjacent corners of a sheet, blanket, or bedcover, and hanging it across a corner of the room,—and if there be not a suitable corner, one can easily be made by opening

a door,—it is possible completely to isolate oneself, and behind the curtain to conduct the bath as if in a different apartment altogether (fig. 5).

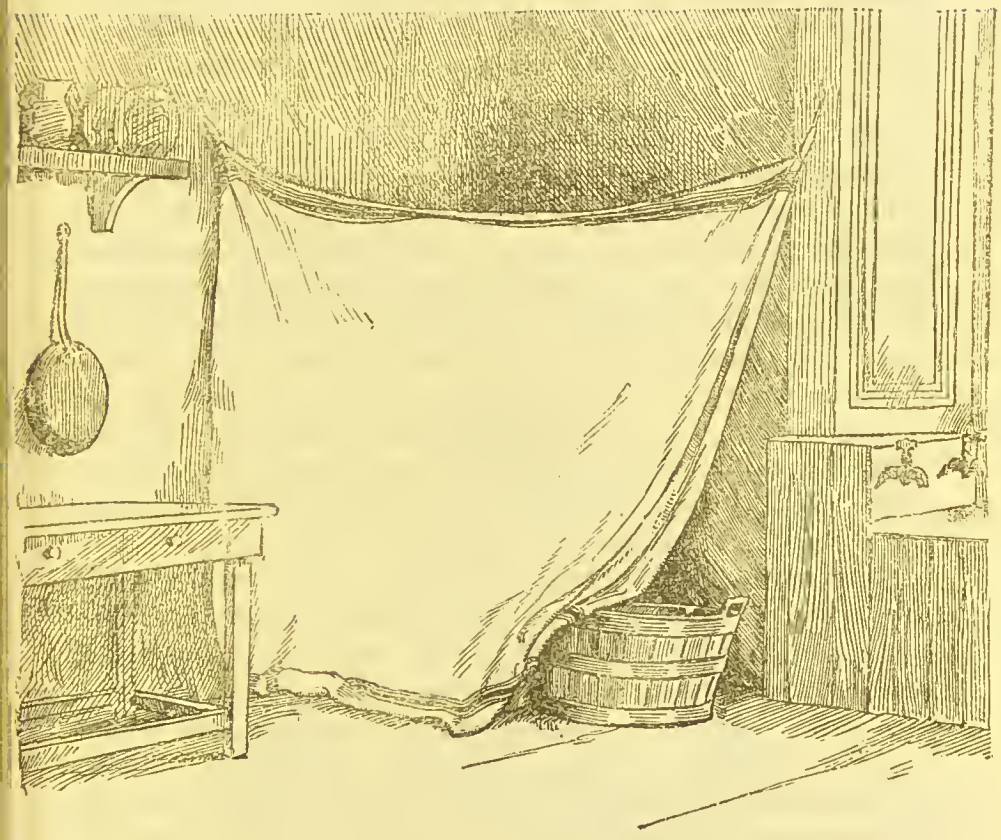


Fig. 5.

SEA BATHING.—The very robust may bathe in the open sea before breakfast, but the best time for those of moderately strong constitution is about two hours after breakfast. Weakly adults, the aged, and children under two years of age, should never bathe in the open sea. It is best not to bathe with an empty stomach, and not soon after a meal (about two hours), not if one is much fatigued, nor if there be emotional excitement. Neither should sea bathing be indulged in by those who are bloodless, or

who have weak circulation, or heart disease, or chronic lung disease, or congestions of internal organs such as stomach or kidneys. The caution not to bathe soon after a meal should be specially observed by swimmers. They have sometimes a tendency to sickness, should the food be ejected from the stomach it may be drawn into the windpipe and cause an immediately fatal result.

The tyro bather should undress quickly, go rapidly into the water at once, over the head several times, then out and dry with a rough towel, dress rapidly, and take a brisk walk afterwards. The robust may remain a longer time in the water. As inflammation of the ears is occasionally produced by the entrance of water into them, it is better to prevent this by putting in a small piece of cotton wool, which the bather ought not to forget to remove afterwards. If the body is warm it is best not to wait for cooling, because if the surface is chilled before going into the water the reaction is less likely to be good. But if the bather be subject to cramp he ought not to go into the water while very warm, or at least not beyond his depth.

Bather's Cramp is often caused by the shock of cold water to the surface under certain conditions. There is usually a constitutional peculiarity predisposing to it, and robust middle-aged males seem to be more liable to it than others. The body being very warm, fatigue, prolonged muscular exertion, and sudden severe muscular effort, favour its production. Those, therefore, who are subject to cramp ought not to go into deep water if any of these conditions be present. One who is frequently troubled with cramp ought not to go into deep water at all.

If a bather is seized with cramp he must endeavour to retain his self-possession, if he lose this his case is hopeless. If the cramp be in one leg, it ought to be maintained extended at rest, and by means of the arms and the other limb the swimmer may make way, or by the hands only he may maintain himself erect until it has passed off. It has also been recommended that the bather throw himself on his back and kick out vigorously. For general cramp of the chest muscles there is no treatment available.

Should a bath in the sea be followed by chilliness, headache, feeble digestion, or sluggishness of the liver, the immersion has been too long, or the bath is unsuitable and ought not to be repeated. It is cruelty to force nervous children into the sea; the emotional condition of terror will most likely prevent that reaction upon which benefit from the bath depends.

I hope that many of you may become very frequent bathers, but so careful that no danger will arise to yourselves. As, however, you may see others in danger from drowning, you ought to know how to afford aid to the drowned. You may send for medical assistance, but if this is all you do the medical aid will probably not be of much avail. Howard's plan of treating the drowned is, I think, the most efficacious and the simplest.



Fig. 6. To press the water out of chest.

"1. *Instantly* turn the patient downwards with a large firm roll of clothing under stomach and chest. Place one of his arms under his forehead, so as to keep his mouth off the ground. Press with all your weight two or three times, for four or five seconds

each time, upon patient's back, so that the water is pressed out of lungs and stomach and drains freely out of mouth. Then,



Fig. 7. To initiate respiration.

"2. Quickly turn patient face upwards, with the roll of clothing under back, just below shoulder blades, and make the head hang back as low as possible. Place patient's hands above his head. Kneel with patient's hips between your knees, and fix your elbows firmly against your hips. Now—grasping lower part of patient's naked chest—squeeze his two sides together, pressing *gradually* forward with all your weight, for about three seconds, until your mouth is nearly over mouth of patient; then, with a push, *suddenly* jerk yourself back. Rest about three seconds; then begin again, repeating these bellows-blowing movements with perfect regularity so that foul air may be pressed out, and pure air be drawn into the lungs, about eight or ten times a minute, for at least one hour or until patient breathes naturally.

"*Note.*—The above directions must be used on the spot, the first instant the patient is taken from the water. A moment's delay—and success may be hopeless. Prevent crowding around patient; plenty of fresh air is important. Be careful not to interrupt the first short natural breaths. If they be long apart, carefully continue between them the bellows-blowing movements as before. After breathing is regular let patient be rubbed dry,

wrapt in warm blankets, take hot spirits and water in small occasional doses, and then be left to rest and sleep."

THE WARM BATH is not nearly of such general application as the cold and cool bath. For the purpose of thoroughly cleansing the skin it is more useful than the cold. The warm bath should be taken in the evening, and those who have not the means of bathing at home, but who go to a public bath, ought to take a cool or cold shower afterwards, in order to brace up the skin and so to avoid the danger of a chill from the effect of cold upon the skin while the vessels are still in a partially paralysed condition. As the warm bath is sedative in its action, it should not be used very frequently unless followed by the cold affusion.

The very warm bath is enervating, and it was in consequence placed at one time under the ban of the Church. It should not be used by those who have tendency to faint. If after a day of great fatigue the muscles are tired and stiff a warm bath in the evening for twenty minutes or half an hour will, by facilitating the transformation in the tissues, remove the sense of fatigue much sooner than it could be done by rest alone. Napoleon after a day of fatigue, instead of seeking rest in sleep, so refreshed himself by a warm bath that he was able to continue a march overnight and, if need be, to engage the enemy the next day.

Those of rather delicate constitution, and those recovering from some debilitating illness may, by sponging with warm or tepid salt water, obtain an amount of stimulation which could only have been attained by the use of fresh water of a cooler temperature. Such a bath is very useful for delicate children the subject of frequent cold in the head and chest, who cannot bear even the milder form of cool sponging without catching fresh cold. By the persistent use of tepid or salt water sponging they may become much less like hot-house plants.

THE HOT BATH can only be borne for a very short time. It powerfully excites the action of the heart.

THE RUSSIAN BATH ought not to be taken by those affected with palpitation of the heart, heart disease, or fulness of head.

THE TURKISH BATH should not be taken very frequently.

especially by those who are not very robust. In the hot chamber the reclining posture should be maintained, and very little conversation allowed.

Those with heart disease or palpitation should not indulge in the Turkish bath, and those who cannot perspire in dry air should not take it unless there is a vapour chamber in the baths.

In the SWIMMING BATH we recognise one of the best means of obtaining active exercise for all the muscles. If the chill be taken off the water there are few of moderately good constitution who may not indulge in it. Every child ought to be taught to swim. One never knows when this accomplishment might be turned to use, either for self-preservation or to save the life of another.

THE BATH IN THE TREATMENT OF ILLNESS.—If it be of importance to attend to the skin in health, it is equally important to do so in many diseases, specially in those of kidneys and of lungs. Although the employment of baths in the treatment of disease is too extensive and two difficult a subject to be treated of in detail in a course such as the present, I ought to mention its use in a few of the more frequent ailments.

Some young children are very liable to become feverish from slight exciting causes. The irritation of teething (not always a slight cause), too much food, indigestible food, constipation, are quite sufficient to make some children very hot and restless, specially towards evening and at night. Frequently the first named cause predisposes to and acts in conjunction with one of the other causes. If the exact cause is known it should be removed, but it may be unknown, or it may be impossible at once to remove it. In any case a quiet night may often be obtained by immersing the child in a warm bath, not a hot bath, but one about 98°, the whole body to be kept under water for seven or ten minutes. On removing the child from the bath it should be quickly dried and put in a warm bed. In this case it is not necessary to remove every trace of moisture from the skin.

When a child is feverish, it is sometimes afraid of the bath, although it is not so at other times. In such an event the bath

may be covered with a piece of blanket in the way already described.

You may remember that the effect of a warm bath is sedative; by means of such a bath the fever is reduced, the skin begins to perspire, and often the child drops off quietly to sleep.

Under precisely similar conditions some children are very liable to convulsions. In such a case the plan of treatment just described should be adopted, and if the head be very hot a single or double fold of rag (not a thick pad) moistened with cold water may be placed on the head and moistened from time to time. The medical attendant in this case should be sent for without delay.

When convulsions arise in consequence of exhaustion from diarrhœa this treatment will not avail.

Sometimes in an emergency there is difficulty in obtaining a sufficient supply of warm water for a bath. A deep can, such as is often used for keeping bread in, may be made serviceable with a small quantity of water.

Headache accompanied by a feeling of fulness in the head and throbbing may be relieved by means of the foot-bath. A deep vessel should be used, the water as hot as can be borne, with a little mustard in it, and the feet immersed therein for 20 minutes. The same may be found serviceable at the commencement of cold in the head.

After fatigue or a chill a warm bath 100° to 102° may be taken at bed-time. Should there be no regular bath available a tub may be used, the bather sitting in the warm water with a blanket enclosing both bath and bather, only the head being left exposed.

At the commencement of a cold the following method of using the vapour bath may be tried. Mr Grantham's directions:— "Boil two gallons of water; at the same time put into the fire half a brick, which must be heated to redness; have a cane-bottomed chair and a hot bath to the feet, with a large blanket in the room; put the boiling water into an earthen pan, and place it under the chair, then put the red-hot brick into the pan.

The patient is to be seated on the chair in a state of nudity, with the feet in the foot-bath, and then to be covered, excepting the head and the face, by the blanket. By these means the steam is kept up on the surface of the body for the space of fifteen or twenty minutes; after which the patient is to be well dried, and be placed between blankets."

In such a case the following simple plan is often efficacious. Two or three large smoothing irons are heated at the fire; when very warm each iron is wrapped in several folds of damp flannel, then placed upon a flat plate, and put under the bed clothes at a little distance from the patient's body. A warm drink is administered. The result is usually copious perspiration.

PUBLIC BATHS.—The customs as to washing and bathing are extremely various in different countries and at different times. Our countrymen, when in warm climates, use the bath more frequently than when at home. Speaking generally, it would appear that the frequent use of the bath has at all times accompanied the progress of civilization. The difference is seen between the less and the more refined, even in the same country (in naming refinement I do not refer merely to a difference constituted by pounds, shillings, and pence) on the outskirts of civilization the bath may be little known. A gentleman travelling in the far west passed the night at a wayside tavern; he found in the room no arrangement for washing, and on applying to the landlord he was told, "Folks generally wash outside the door if they want to wash at all." The traveller ordered a basin and water to be taken outside the door, and while he performed his ablutions several of the inhabitants "hung raound," watching with interest what seemed to them to be a most novel proceeding.

As in our own country so in early Rome the weekly bath was a national custom, but later, and during the empire, the daily bath was considered to be almost a necessary of life. It was taken before the evening meal, the time for which was not later than three o'clock, frequently earlier. The baths were favourite places of public resort, in some respects resembling our clubs, at which politics and other questions of the day were discussed. In

addition to numerous private adventure baths there were magnificent Thermae or public baths erected by Agrippa and by various of the emperors. Those who have not visited Rome can have very little idea of the enormous scale of these monuments of the emperors, for such they were in reality. The baths of Caracalla were nearly a mile in circumference—770 ft. long, 325 ft. wide;—they accommodated 1600 bathers, but those of Diocletian were still more extensive. Forty thousand Christians are said to have been engaged upon their construction. They covered an area of 150,000 square yards, and could accommodate 3200 persons. They are now occupied as studios, granaries, prisons, two churches. The church of Sta Maria degli Angeli, built by Michael Angelo, is shapen out of the Caldaria (hot air chamber). In it one still sees the massive columns of Egyptian granite; from the vaulted roof still hang the metal rings from which were suspended the lamps which shone upon the Romans of those days as they enjoyed their bath. Where was formerly the swimming bath (200 feet long by 100 feet wide) is now the cloister of the Convent of the Certosa. In the earlier days admission to the baths cost the enormous sum of less than a farthing of our money, but to the thermae of the emperors with their gymnasia, conversation-rooms, theatricals. races, &c., admission was free. The bath became such an institution that wherever a Roman colony was planted baths were established. The English town of Bath owes its origin to the Romans, and in Strand Lane, London, till a recent date, were remains of the old Roman baths.

But the Roman of to-day has not preserved the proclivities of his forefathers. Not very long ago the recommendation to take a cold bath elicited from one of them the reply, "What? Wash me from head to foot in cold water I shouldn't dare to do it! I never did it in all my life."

But let us inquire what facilities for bathing are provided nearer home.

Bradford has baths and washhouses in Thornton Road, which, during the year ending 31st August 1884, were patronised by

125,770 bathers. The year previous the number was only 110,180. For that year the—

Expenditure was, . . .	£2126
The receipts, . . .	1742
Leaving a deficit of, .	£364

The cost of establishing the baths was £7500, exclusive of site, which previously belonged to the Corporation.

A year ago Turkish baths for ladies only were opened at Lister Terrace.

The experience of these two sets of baths has been so satisfactory that orders have been given for the erection of another set at a cost of £7000, and it is proposed if these be successful, still further to increase the facilities for bathing.

Liverpool, with a population of 552,425, has seven public baths and four public wash-houses (one wash-house, three baths and wash-houses, and three baths only). The number of bathers during the year ending 31st August 1883 was 527,941 ; the number of washers for the same period, 150,545, equal to the large number of 2895 washings every week in the year. The total annual

Expenditure was, . . .	£11,814
Income, ...	9540
Leaving a deficit of, .	£2274

The smallest loss on an individual house was on the baths in Cornwallis Street—£61 ; the largest was on the baths and wash-houses in Burroughes Gardens—£549.

Birmingham, with a population of 400,757, has five sets of public baths (one of them an open-air swimming-bath). There are in all 209 hot and cold baths, 3 suites of Turkish baths, and swimming baths covering an area of 3017 square yards.

During the year 1883 there were—

Male bathers, . . .	306,839
Female bathers, . . .	18,236
Children, . . .	60,896
Total, . .	385,971

These baths were established at a cost of £75,000 (including cost of sites).

The working expenses, 1883, .	£5438
Receipts, . . .	5428
Deficit, . . .	£10

exclusive of interest, or of provision for extinction of capital charge, both of which fall upon the rates.

Glasgow, with a population of 674,095, has four public baths and wash-houses open to the public, and a fifth is nearing completion. During the year ending 30th September 1884 they were patronised by—

Male bathers, . . .	327,196
Female bathers, . . .	10,184
	337,380

The number of washings—

Public, ...	30,735
Private, ...	11,182
	41,917

Equal to 806 washings every week in the year. The private washings are done for private families by the washing-house attendants.

For that year the

Expenditure was, . .	£7938
Revenue, . .	5891
Deficit, . . .	£2047

The item expenditure includes interest on capital, but no deduction for depreciation nor for diminution of capital charge. No charge is made for water.

The four baths in operation cost for sites, buildings, and furnishings, £80,000. They contain 1855 square yards of swimming baths and 330 bathing-boxes, 141 hot baths and 264 washing-stalls. The baths which are nearing completion have 2 swim-

ming baths, 413 square yards in area, with 67 bathing-boxes. They have also 33 hot baths, and 54 washing-stalls.

Edinburgh, with a population of 236,002, has no public baths, and the private adventure baths at Pitt Street and elsewhere are insufficient for the community. Fortunately the facilities are soon to be extended by the opening of a complete set of baths at Drumsheugh, which will no doubt help to meet a want which has been much felt in our city.

It becomes us to discuss on its own merits the question whether there be any necessity for such institutions, and if so, under what conditions they may be expected to be useful, lest we find ourselves striving to follow a course simply because it has been taken by others.

Practically it is possible for every one to have his morning tub at home. How this may be managed, even in houses of very limited accommodation, we have already shown; but though in many even of the smaller houses of recent construction there is a fitted-in bath, much the larger portion of our population cannot obtain the luxury of a warm bath comfortably and properly except at public baths. Then we must recognise that a large portion of the juvenile members of our population cannot have household arrangements to suit their convenience even if they desire the bath. Of course, Turkish baths can only be had at public institutions; and as regards swimming-baths, the sea is too far distant, and during a great part of the year too cold for most constitutions.

If public baths are a necessity, under whose auspices should they be established? It is not desirable that municipal authorities should undertake that which can be equally well done by private enterprise. But under the most favourable conditions the smallest charge which would be remunerative to the proprietors of private adventure baths would exclude a large mass of our population too poor to enjoy the luxury of a bath at these establishments who ought to have it placed within their reach.

But to go further. If private enterprise fail to supply a want, and if it can be shown, from a sanitary point of view, that the

establishment of public baths would be beneficial, then it becomes a matter to be undertaken by the municipal authorities.

The association of poverty and dirt is so general that it will be universally admitted that they are related in some very intimate way. The association is so general as to exclude the idea of its being accidental. But it is not an inseparable connection. We have seen the houses of the poor in which everything was as clean as rubbing and scrubbing and soap could make them—in which everything about the person was equally clean. Poverty is not a necessary cause of dirty and untidy habits. A careful investigation will reveal the fact that dirty and untidy habits are a frequent cause of poverty—or, at least, that they are the common offspring of laziness and idleness. Dirty houses, dirty clothing, dirty companions, certainly lower a man both morally and physically; they lower him in his own estimation, as well as in the opinion of others (of course, I do not refer to the honest sweat and dust of work hours). Personal cleanliness and a tidy house increase a man's self-respect, companions of a like mind are calculated to stimulate to a similar course of action. The old-fashioned tub-night is a most healthful and important national institution, and along with the clean linens and better clothing worn on the Sabbath-days, does much to maintain the self-respect of our people.

There is another associate of dirt which must not be overlooked while considering the propriety of municipal baths. The associate referred to is *disease*. It is a not very uncommon consequence of want of cleanliness. Specially in large communities is it of importance that the health of all the members should be cared for in consequence of the tendency of disease to spread. Apart from this, sickness means a loss not only to the individual but, more or less, to the whole community.

Bacon says "that cleanliness of body was ever esteemed to proceed from a due reverence to God." It is as true now as ever it was that "cleanliness is indeed next to godliness." Now that we are learning more of the influence of minute organisms in the processes of decay and disease, we can better

appreciate the wisdom of the Mosaic injunctions in the Ceremonial Law relating to washing and bathing, all the more important seeing they were written for the inhabitants of a warm climate.

The opportunity to wash and be clean should be placed within the reach of all. Probably many are too old to learn, but we may adopt the plan so strongly recommended by the founder of our ragged schools, and by teaching the children the next generation will be benefited. Children are usually fond of the water, especially if they think that they ought not to go near it. Education ought to be not only a training in language or science, but also in cleanliness, self-control, and politeness. These branches can usually be better undertaken by the parents, but when parents are incapable of giving this training the schools should initiate and in any case endeavour to carry it on. If in some of the public schools in England too much time is bestowed upon the muscularity of the pupils, in Scotland too little attention is paid to that soundness of body, upon which in some measure the healthy thinking faculty depends. Our School Board seems recently to have become convinced of this, seeing that they have arranged to provide baths and a gymnasium at the Royal High School. Baths are, however, really more required in connection with schools for the poorer classes, who have fewer facilities for bathing at home. To supply this want would involve the erection of baths in connection with each Board School, for which, of course, the ratepayers would be taxed. It is deserving of careful consideration whether it would not be less costly to erect public baths, under the care of the municipal authorities, which would be available for all the public, and to which Board School children could be admitted at a very small sum. To induce them to use the baths there might be prizes for competition among the members of each school as well as inter-scholastic competitions.

In a paper read at the Social Science Congress, 1883, Dr Norman Porritt stated that at Bradford boys use the Corporation Baths at a reduced charge. In all the new schools at Liverpool

plunge baths are provided, while at Birmingham last year 31,202 bath tickets were issued to Board School children at a charge of a halfpenny each, a prize being given to all who learned to swim one length of the bath in a season, special prizes being offered for competition between the schools.

In 1884 the number of school children using the public baths at Birmingham was 60,896, nearly double that of the previous year.

It will be observed that in all the instances cited the public baths were not a financial gain to the town, at least directly, but how far they were a gain indirectly there is no means of estimating. Public parks do not pay financially, but by improving the sanitary and social condition of the people they are indirectly beneficial. So public baths are in like manner a gain, probably not less in quantity.

I have no doubt but that our municipal authorities are quite ready to enter heartily into this matter so soon as the ratepayers indicate their desire to pay the small extra sum which would be required for the purpose. Were it possible to have baths adjoining some manufactory in which steam power is employed, the waste hot water and steam might be had without cost, perhaps in sufficient quantity to supply all the heat which would be required.

THE HAIR.

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I have chosen "the hair" as the subject of my lecture to-night. It is true that the hair is in a great measure merely an appendage of the body, and one the condition of which does not affect us to such a degree as many of the organs which have been described to you in previous lectures, yet at all times and in all countries man has instinctively attached the highest importance to his crinal decoration. When I tell you that to make up for the ravages that time effects upon the head, more than a hundred tons of human hair are imported every year into Paris alone, and that white elderly hair of good quality sells for one guinea an ounce, you will understand the value set upon nature's covering. You will also understand the anxiety which we all feel to retain that which nature has provided for us free of cost. But this is a minor point. A wholesome condition of the hair is absolutely essential to our comfort and health. It behoves us, therefore, to give some attention to its structure and mode of growth, in order that we may thereby place ourselves in a position to care for it in a right manner.

Distribution of the hair upon the body.—With the exception of the palms of the hands and the soles of the feet the skin is almost everywhere studded over with hairs. In few localities, however, does the hair attain any degree of thickness and length. These regions are the scalp, the eyebrows, the margins of the

eyelids, and in man the cheeks, chin, and upper lip. Elsewhere the hairs, as a rule, are fine, short, and scanty, and in the female they are usually so extremely delicate that the skin appears perfectly naked.

Arrangement of the hair.—A very superficial examination is sufficient to show that the hairs do not proceed perpendicularly from the surface. They emerge from the integument in an oblique or slanting direction. It would occupy too much time were I to attempt to describe to you the manner in which the hairs are arranged over the entire surface of the body. I shall therefore merely allude to the hair of the head, face, and limbs. Look at the scalp of a boy, or, still better, of a newly born infant, and you will notice that the hair is disposed in vortices or whorls which have their centre on the crown. The hair-whorls sweep round this centre from right to left. A nurse is well acquainted with this arrangement. If you watch the manner in which she soaps and washes the head of a child you will observe that she carries her hand in the direction of the hair-whorls, and therefore describes with the sponge a series of circles around the centre on the crown.

The hairs of the eyebrows describe a fine arch above the orbits, and have a general direction from the root of the nose outwards. The more gentle the curve which is thus formed, the more pleasing is the expression given to the face, and frequently art is called in to help in giving a result which nature has denied —not always, however, with the best effect, because the arch corresponds with the arch described by the margin of the orbit, and, if the artist neglect this, the result may not be altogether happy. The individual hairs of the eyebrows are short and stiff, and terminate in a fine point. Further, the upper hairs incline downwards, whilst the lower hairs incline upwards. They thus oppose one another like sheaves of corn set up against each other in a harvest field.

It is sometimes stated that the possession of eyebrows constitutes a point of difference between man and the apes. This is hardly correct. In the chimpanzee there are certain hairs which

spring from the naked skin above the orbits, which undoubtedly represent the eyebrows of man; and even in the hairy face of the baboon there are long hairs which rise beyond the others in this region.

The eyelashes are arranged in rows along the margins of the eyelids. In the upper lid the hairs are longer than in the lower lid, and in some cases they may be seen to constitute as many as four distinct rows.

The moustache is formed by a stream of hair which passes outwards on each side upon the upper lip. Corresponding currents of hair pass out from the middle line of the lower lip, and these meet the downwardly directed hairs of the cheek and chin to form the whiskers and beard.

The disposition of the short hairs on the limbs presents some curious and interesting points. In the upper limb the general direction of the hair is towards the point of the elbow: in other words, it inclines downwards upon the upper arm, and upwards on the forearm. In the lower limb the arrangement is just the reverse, as it is directed away from the knee-joint, viz., upwards on the thigh and downwards on the leg. This corresponds in every respect with the disposition of the hair on the limbs of the orang, chimpanzee, gorilla, and a number of other apes. How is this curious arrangement to be explained? Certain naturalists hold that the hair is thus enabled to act as a watershed. In the midst of the pelting rain, the gorilla is seen to sit in a crouching attitude with his legs drawn in, his knees up, and his hands clapsed over his head. So posed, the water runs easily off his limbs from the everywhere downward inclination of the hair. Are we to conclude from this that man's remote ancestors have sat in a similar attitude, and under similar circumstances? Some say that they have.

Size and number of hairs on the head.—The number of hairs which are implanted upon the head is in a great measure determined by the diameter of the individual hairs. The greater the diameter of the hair shafts, the smaller will be the number of these springing from a given area. Now the diameter of a

hair shaft varies very greatly, and the factors which determine this variation are sex, age, colour, and, above all, race. But before going into this point, let it first be clearly understood that uniformity of diameter never occurs in the same head of hair. Thus in the same individual the thickest hairs on the head may sometimes be found to be at least six times the diameter of the finest. They vary as much as the trees in a forest do in girth of trunk.

It is a curious point that the range of diversity of size in the same individual appears to be more marked in our own civilized heads than in certain less civilized races, such as the New Zealanders and South American Indians. This alone might be considered as indicating that we belong to a more mixed race?

But what is the average thickness of a human hair taken from the head? It has been calculated by Sir Erasmus Wilson to be about $\frac{1}{400}$th of an inch, or as he puts it, if 400 such hairs were laid side by side, they would cover an area of one inch in length. But as I have said, the diameter of the hair is affected by many circumstances. We are in the habit of regarding man as being altogether a coarser animal than woman. This is not the case, however, in every particular, because female hair is, as a rule, not so fine as that of man, and this in spite of the frequent cutting to which the male hair is subjected. As might naturally be expected, the hair of the child is more delicate than that of a grown person.

The effect of the colouration of the hair in determining its diameter corresponds very much with the popular belief on the subject. Flaxen and chestnut hair is the finest; light-brown, and especially black hair, is the coarsest; whilst red and dark-brown hair hold an intermediate position.

The beard and whiskers show the coarsest hairs on the body, the average diameter being $\frac{1}{200}$th of an inch; next in point of thickness comes the hair of the eyebrows, with a diameter of $\frac{1}{250}$th of an inch, and then the eyelashes, with a diameter of $\frac{1}{300}$th of an inch.

Several observers have undertaken the tedious task of counting

the number of hairs growing from the scalp. According to Sir Erasmus Wilson the average number is 120,000. But this is greatly influenced by the colour of the hair. Thus another observer has shown that a square inch of scalp will hold 728 flaxen hairs, 678 chestnut hairs, and only 588 black hairs.*

It follows from this that our blonde beauties have a distinct advantage over our brunettes in so far as the number and fineness of their hairs is concerned. In fact, a lady with a good endowment of flaxen locks, combs out and disentangles each morning she performs her toilet somewhere between 70 and 90 miles of hair. This is a doubtful advantage, however, and one which I am sure she would gladly dispense with, when I tell her, that there is reason to believe that she is at a slight discount in the matrimonial market. Statistics would seem to show that brunettes are more successful in obtaining husbands in the proportion of about three to two.† Poets have a proverbial preference for fair hair; no poem is complete without a flaxen-haired maid, but prosaic mortals in search of a wife seem, upon the whole, to prefer the brown and the black. According to Dr Beddoe, the result of this "conjugal selection" appears to be that in some parts of England fair hair is slowly disappearing, whilst dark hair is becoming more prevalent.

* The results obtained by counting the hairs over the entire extent of scalp in four heads of different colours are very similar to the above, viz.—

Red, . . .	88,740
Black, . . .	102,960
Brown, . . .	109,440
Blonde, . . .	140,409

† Table copied from Dr Beddoe's article "On the supposed prevalence of dark hair in England."—(*Anthrop. Rev.*, vol. i.)

Social Condition.	Colour of Hair.				
	Red.	Fair.	Brown.	Dark-Brown.	Black.
Married, .	67	55·5	60·5	69·5	79
Single, .	30	37	30·5	22	18
Doubtful, .	3	7·5	9	8·5	3
Totals, .	100	100	100	100	100

Purposes fulfilled by the hair.—A very important question now comes to be discussed—Is the hair on our bodies subservient to any useful purpose, or has it been retained simply as an ornament? With regard to the eyebrows and eyelashes there is little difficulty in coming to a decision on this point. Socrates was fully cognisant of the use of these when he said, "Think you not that it looks like the work of prescience, because the sight is delicate, to have guarded it with eyelids . . . . to have fenced these lids with eyelashes which, like a sieve, strain the dusty wind and hinder it from hurting the eyes; and over the eyes to have placed eyebrows, as eaves, to carry off the sweat of the brow from disturbing the sight."

The hair of the head has also its function. Hair is a bad conductor of heat. It therefore tends to equalise the temperature of the head, and in this way acts as a protective covering to the subjacent brain, sheltering it on the one hand from cold, and on the other hand from the heat of the sun's rays. Nowhere will you see hair of more luxuriant growth than upon the heads of the blue-coat boys who trust to nature alone for a head-covering. Moreover, the hair of the head is said to be sensibly thicker in some arctic races.* Still we cannot doubt that it is there also for ornament as well as use, and that conjugal selection has had much to do in determining its richness of supply.

The moustache and beard guard the air-passages in the same manner that the eyelashes guard the eyeball. They stand as sentinels at the orifices of the nose and mouth, and challenge the entrance of foreign matter. The moustache especially is of immense service to millers, bakers, masons, and all workmen engaged in dusty trades. Further, the beard acts as an admirable protective covering to the throat. Instances of the benefit resulting from the growth of the beard in individuals with throats sensitive to cold are so well known that I need hardly allude to them.

But why is woman denied these advantages? Some think that she also at a very remote period enjoyed the same benefits, but that she lost them through doubts arising in the mind of

* "The Human Species," by Quatrefages.

man as to whether a beard and moustache were ornamental appendages in his mate, or perhaps from some unworthy jealousy and a desire to monopolise these badges of lordship for himself. According to Suidas, who lived in the tenth century, the Athenian ladies became very sensitive to their inferiority to man in this respect, and tried hard to cultivate hair on the cheek and chin. In many cases they went so far as to wear false beards.

Every now and again a woman appears with a well-grown beard. There are numerous well authenticated cases of this kind. Allow me to show you the portrait of Julia Pastrana, a well-known Spanish dancer — more distinguished perhaps for the luxuriance of her beard than the excellence of her dancing. Again in London, in 1858, a young woman of twenty had considerable difficulty in persuading a clergyman to perform the marriage ceremony in consequence of her possessing a bushy beard four inches long.

In women who have attained a certain age it is a matter of every day experience to see a tendency to hair growth on the face. This is a circumstance of considerable interest, because we occasionally see changes analogous to this in the lower animals. In the Museum of the University of this city there is a hen-pheasant which has in a measure assumed the plumage of the male bird.*

But a beard is by no means universal amongst men. Thus the Siamese, Malays, Chinese, and Japanese are beardless, and so also are the native Americans. As a rule these races express strong objections to beards. The Japanese ladies consider them "very ugly," and the North American Indians consider them "very vulgar." Upon this principle the latter carefully eradicate with pincers every straggling hair which may from time to time appear on the face. The Indians of Paraguay carry this practice so far that they in addition pluck out both eyebrows and eyelashes. As a reason for doing this they state that they do not wish to look "like horses." Several amusing stories are told of the effect produced by bearded strangers appearing amongst natives entertaining these views. Thus, some officers once landed

* Article by Prof. Turner in Proc. Roy. Phys. Soc., April 1879.

on the Marquesas Islands, and entered into friendly conversation with the people. Suddenly one of their number was violently seized by the chief, and his friends expected every moment to see him murdered. Nothing, however, was further from the mind of the chief. A hair on the face of the officer had offended his ideas of good taste, and he simply wished to perform the friendly act of plucking it out with his shell tweezers.

Let us in the next place consider whether the short hairs scattered over the body fulfil any useful function, and if not, how we can account for their presence. They are so few and short, as a rule, that we cannot regard them as affording the skin an effective covering. Nor can we believe, as some do, that they protect the surface of the body from the effects of friction. Just look at any part of the skin which is especially subjected to friction, as, for instance, the skin of the wrists over which the stiff margins of the cuffs play, and you will observe that instead of the hairs being especially developed they are, in a great measure, rubbed off. Then if they counteract the effects of friction, where should we find them better marked than on the soles of the feet and the palms of the hands, whereas the skin of these regions is characterized not only by the total absence of hair, but also of the power of producing hair. In short, we are driven to the conclusion that the short hairs are rudimentary structures, or, in other words, vestiges of a hairy covering which at one time did fulfil a protective and sheltering function. In this respect they are quite analogous to the rudimentary teeth which appear in the young whale-bone whale. These teeth never cut the gum, and are perfectly useless. The analogy is rendered still more striking by the fact that on certain parts of the body it is no uncommon thing for hair to be formed in the skin which never reaches the surface except to be shed. The skin of the nose is, to all intents and purposes, quite bald, yet minute hairs are being constantly formed in its midst. To prove this you have simply to squeeze out the contents of one of the sebaceous follicles there, and amidst the fat which exudes the microscope will reveal a number of short delicate hairs.

The amount of short hair scattered over our bodies is very variable. In the male it is always more plentiful than in the female, and certain races, such as the Ainos, the Australians, the Todas of the Nilgherries, are distinguished for their hairiness, whilst others, such as the African Negroes and the Mongolians, show scarcely a trace of hair on their body. Amongst the Ainos, indeed, the hair over the shoulders and on the back and limbs is sometimes so thick and long as to deserve the name of fur.

I have referred to curious cases where the beard is developed in women. We meet with equally interesting instances of excessive hair-growth over the entire surface or part of the body. Two years ago Farini exhibited a little girl of seven years old called Krao, whose body was covered with a thick coating of hair. He called her the "human monkey," and claimed that she was the long sought for "missing link." Need I say how ridiculous these assertions were. Krao was merely a human child in whom the short hairs of the body were excessively developed. I shall now show you her photograph projected upon the screen. I may mention another case which occurred in London in 1865, in a girl of twelve years old. From the illustration which I show you you will observe that the excessive hair-growth is limited in this case to the upper part of the body.

General hairiness of the body appears to be a character which is readily transmitted. Krao's father was said to be hairy, and at the Court of Ava there is a family in which this peculiarity has appeared in three generations. This curious case is placed altogether beyond the range of doubt. We have the independent evidence of two thoroughly reliable authorities who saw and figured the three members of this remarkable family at different times, viz., in 1829, when the family consisted of father and daughter; and in 1855, after the daughter had been married and had borne several children, of which one exhibited the peculiarity.*

* John Crawford's "Journal of an Embassy from the Governor-General of India to the Court of Ava." Captain H. Yule's "Narrative of the Mission sent by the Governor-General of India to the Court of Ava."

Structure of the hair.—Up to the present I have said nothing of one of the most important points which we have to consider in this lecture, viz., the structure of the hair and the manner in which it is implanted in the skin.

We generally describe a hair as consisting of a root, a shaft or stem, and a point. The *root* is the short soft and slightly expanded portion which is withdrawn from the skin when a hair is plucked from the body; the *shaft* is the part which projects beyond the surface of the integument; and the *point* is its attenuated free extremity.

The root of the hair is contained within a minute tubular recess in the skin, which is termed the *hair-follicle*. This is the chamber in which the hair is manufactured; it is here also that additions are made to its root, so that it increases in length. In short, the hair-follicle is a little laboratory in which the entire process of hair-production and hair-growth is carried on. It is very essential, therefore, that we should know something of its structure.

The skin, as you are doubtless aware, consists of two layers of totally different constitution, viz., an outer *scarf-skin* or *epidermis*, and an inner *true-skin* or *corium*. The scarf-skin consists of an enormous number of minute microscopic bodies called cells heaped together and joined the one to the other by cement substance. It is essentially the protective layer, and with this end in view, the superficial cells become flat and horny. The hair and nails are appendages or outgrowths of this scarf-skin or epidermis, and amongst the lower animals the claws, hoofs, spines, feathers, scales and so on, all belong to the same category, all are modifications of the epidermal layer.

The *true-skin* or *corium* is not cellular but fibrous in its construction. It is composed of fine fibres running in all directions, and woven together so as to form a tough pliant stratum. The web thus formed is exceedingly dense and close near the surface, but the deeper we go the more open and lax does it become, until it passes insensibly into the subcutaneous fatty tissue—a fatty layer which constitutes the cushion upon which

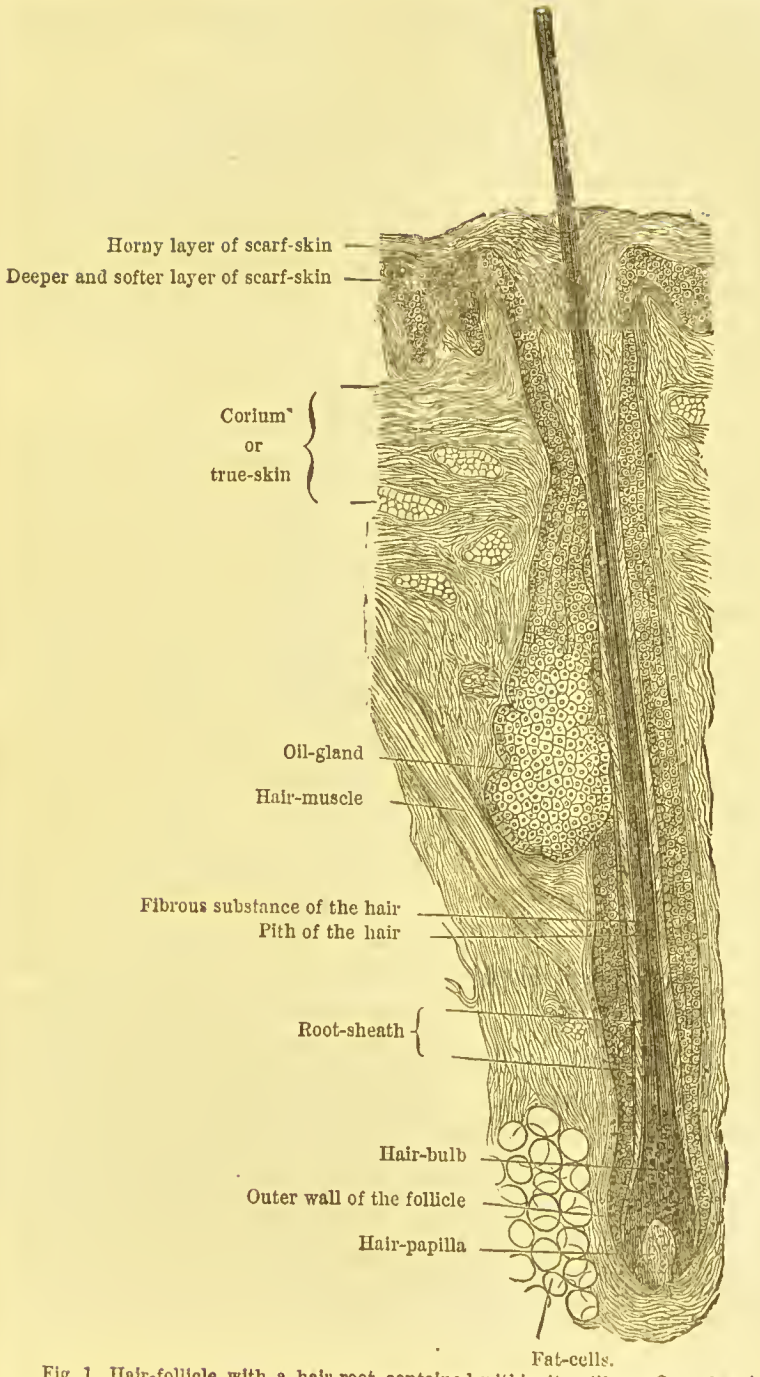


Fig. 1. Hair-follicle with a hair-root contained within it. (From Gegenbaur's Anatomy after Biesiadecki.)

the skin rests. Unlike the epidermis, the true-skin is plentifully supplied with blood-vessels.

Both layers of the skin take part in the formation of the hair-follicle. It is, as it were, a narrow tubular depression of the skin which has carried both epidermis and corium before it (Fig. 1). The wall of the hair-follicle has therefore two distinct layers entering into its formation—the inner layer being cellular and epidermic, whilst the outer layer is fibrous and continuous with the corium. When a hair is plucked from the skin the inner layer of the follicle adheres to the root, and is in great part withdrawn with it. It is therefore termed the *root-sheath.*

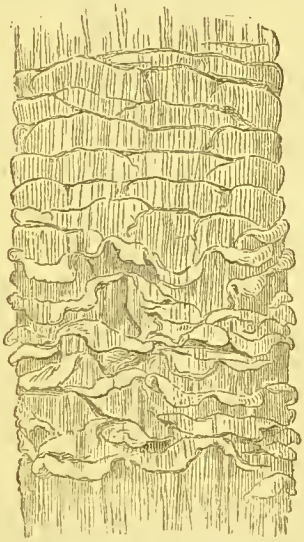
But you ask, what is the depth of a hair-follicle, and is it equally deep in every case? It varies very greatly in this respect. Those which hold the short hairs do not sink beyond the skin. The follicles of the larger hairs of the scalp and beard on the other hand are much longer, and penetrate beyond the skin into the subcutaneous fatty tissue. Another point to be noticed in connection with the hair follicle is this: that, with the exception of those which contain the eyelashes, they are seldom perpendicular to the surface. They have a slanting or oblique direction.

Let us now enquire into the manner in which a hair is fixed in its follicle. If you examine a fresh hair-root, you will notice that its extremity is expanded into a knob which we term the hair-bulb. This hair-bulb is composed of cells like those of the root-sheath, and at the bottom of the follicle the two are directly continuous with each other around the circumference of the bulb. Again, at the bottom of the hair-follicle there is a little fungiform projection continuous with the fibrous corium. It is called the *hair-papilla*, and contains both blood-vessels and nerves (Fig. 1). As we shall afterwards see this papilla is of the utmost importance in connection with the process of hair growth. It is also an agent, however, in fixing the hair in its follicle. The lower aspect of the hair-bulb is hollowed out into a cavity, and the papilla is received into this in the same manner that a head is received into a cap (Fig. 1).

If you have followed what I have said, you will see that the

hair-root is attached to its follicle, (1) by a continuity at the bottom of the follicle of the cells composing the root-sheath and of those forming the hair-bulb, and (2) by the hair-bulb being moulded over the papilla in the same manner that the socket of a ball and socket joint is moulded over the ball. There is yet a third connection, but to understand this we must in the first place study the structure of the hair stem.

When a twig from a young sapling is cut across, we notice that the woody part which forms its chief bulb is coated on the



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Fig. 2. A portion of a hair-shaft to show the external scaly covering. (From Henle's "Anatomie des Menschen.")

outside by a thin bark, and that running along its centre is the cellular pith. A hair has parts exactly analogous. The bark of the twig is represented by a thin external scaly layer termed the *cuticle;* the woody portion has its analogue in the *fibrous substance* of the hair; and the pith has its representative in a cellular core which we call the *medulla.*

The *hair-cuticle* is exceedingly thin. It consists of a single

layer of minute flat scales arranged upon the surface of the hair like the scales on the skin of a fish or a serpent. They are not disposed so regularly however, and they overlap each other like the tiles on the roof of a house, with this exception, that the overlapping takes place in an upward direction from the root to the point of the hair (Fig. 2). The free uncovered margins of the scales, therefore, look upwards, and when a hair is examined by a microscope, they show in the form of wavy lines, and at the



Fig. 3. Hair-root drawn away from the follicle. It shows how the upwardly directed scales on the surface of the hair-root are adapted to the downwardly directed scales which line the hair-follicle. (From Henle's "Anatomie des Menschen.")

1. Fibrous substance of the hair.
2. Scaly covering of the hair.
3. Scales lining the hair-follicle.
4 and 5. Wall of the hair-follicle.

same time give the outline of the hair a slightly toothed or serrated appearance.

This arrangement of the cuticular scales gives to hair a property of the very highest commercial importance. I refer to *felting*. Human hair is ill adapted for this purpose, because the scales lie too closely to the body of the hair; but wool, in which the scales stand well out, is peculiarly well suited for felting, in so

far that they allow the hairs to firmly interlock the one with the other.

And now that we know the character of the hair-cuticle, we are in a position to understand the third mode of attachment of the hair-root to the hair-follicle—a connection to which I have already incidentally alluded. The hair-follicle is lined by delicate imbricated scales, but these are directed downwards, and are accurately moulded upon the upwardly directed scales which coat the hair-root (Fig. 3). No wonder, then, that when a healthy hair is plucked from its follicle it carries with it the greater part of the root-sheath.

The *fibrous substance* of the hair constitutes its chief bulk. It consists of flattened fibres applied to each other in the longitudinal direction, and firmly cemented together. These fibres, however, are not the ultimate elements of the fibrous substance. Each fibre can be broken up into minute, flattened, elongated plates or cells ; these are glued together by a firm cement.

The fibrous substance is the seat of the strength, elasticity, and in great part of the colour of the hair. But how is this colour produced ? It depends upon two factors, viz. :—(1) the presence of pigment, and (2) the presence of air.

The pigment or colouring matter is somewhat irregularly distributed. It is placed partly within the cells which build up the fibres, and partly in the cement substance which binds the cells together. The air is contained in minute chinks or crannies in the fibrous substance. These are very numerous in white hairs, but are almost entirely absent in black hairs.

The *central pith* is not present in every hair, nor indeed is it to be found throughout the entire length of those hairs in which it exists. Thus it is absent in the fine short hairs which are scattered generally over the body, and also in a large proportion of the hairs of the scalp. It constitutes a central core, which extends from the hair-bulb to within a short distance of the point. A small portion, therefore, of the terminal part of the hair is composed merely of fibrous substance, coated with the scaly cuticle. The pith forms a very inconsiderable part of the shaft of a human

hair, rarely contributing more than one quarter of its entire diameter. In structure it consists of two or three longitudinal rows of rectangular cells which appear like so many strings of beads placed side by side. These cells contain a certain amount of air.

Such, then, is the structure of a human hair, chiefly fibrous, coated by a thin layer of irregularly overlapping scales, and in some cases traversed by a central pith. I should have liked very much to have compared it with that of the hair of the lower animals, but time will not permit of this, as we have still a great number of other topics to discuss more nearly connected with my subject. Allow me to say, however, that the structure of human hair is such that it can almost always be distinguished from hair drawn from other sources, and this is a point of more than mere passing interest.* In many cases it has been the means

* Medical jurists, as a rule, hold that human hair can in all cases be distinguished by its structure. Having some misgivings upon this point, I determined to test it by comparing human hair with that of the anthropoid apes, and my friend, Prof. Haddon, of the Royal College of Science in Dublin, very kindly supplied me for this purpose with a few hairs plucked from the back of the orang, chimpanzee, and gorilla.

The hair of the orang is very much coarser than the head-hair of man, and the pith is present in much greater quantity. When compared, however, with the hair of the human beard, a very close resemblance is manifest. Its diameter may be slightly greater than the majority of human beard hairs, but the proportion between the pith and the fibrous substance is almost identical. In both it forms one-third of the diameter of the shaft.

The hairs of the gorilla and chimpanzee are very similar, and they have a diameter which is perhaps slightly greater than that of the average human head-hair. The pith is better marked, and the proportion between it and the fibrous substance of the hair is more uniform. I was very much struck with the resemblance presented by a hair taken from the head of a Peruvian mummy, which is in the museum of the University of Dublin, and the hair of the chimpanzee. I have made drawings of these varieties of hair, and as they are all represented upon the same scale the reader will easily estimate the points of difference and resemblance. I may mention that the beard-hair and the portion of the hair of the gorilla which is

of detecting criminals, or removing suspicion from innocent people, as, for instance, where hair has been found clinging to clothes or instruments which have been used for murderous purposes. Not long ago, portions of a dry parchment-like substance were found nailed to the doors of certain very old churches. On these being removed, minute hairs were observed springing from the surface, which on examination proved to be of human origin. The parchment was thus proved to be human

figured were white. In Waldeyer's atlas of the hair, a hair of the chimpanzee is figured alongside a black and a white human head-hair, and in diameter it is the smallest of the three. His figure of the white human

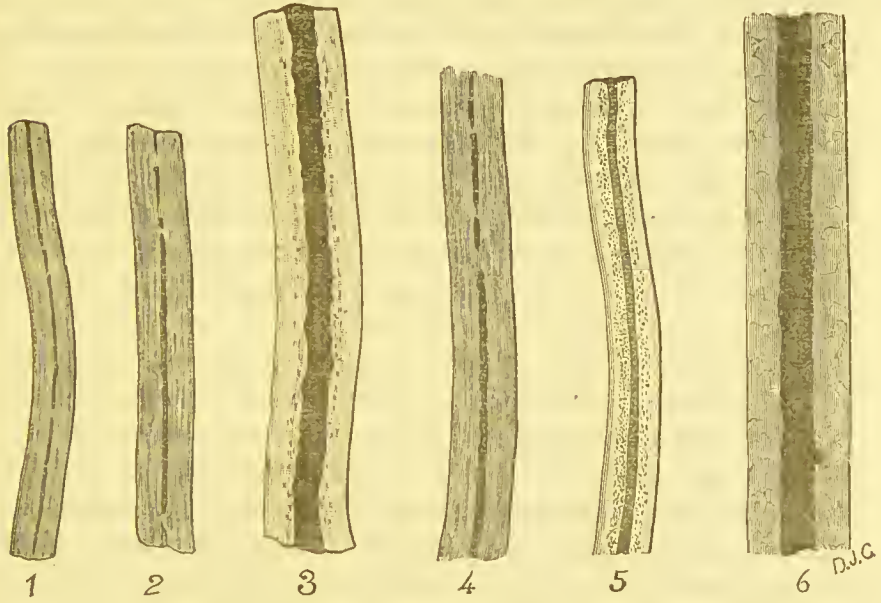


Fig. 4. 1. Human head-hair. 2. Head-hair of a Peruvian Mummy. 3. Human beard-hair. 4. Hair from the back of the Chimpanzee. 5. Hair from the back of the Gorilla. 6. Hair from the back of the Orang-Utan.

head-hair is almost identical with the drawing which I have given of the hair taken from the back of the gorilla.

I have come to the conclusion, therefore, that it would be extremely difficult to distinguish human hair from the hair of the anthropoid apes. Indeed, I believe that in many cases it would be impossible.

skin, and represented the hides of some unfortunate individuals who had been flayed for sacrilege.*

Oil-glands and hair-muscles.—In connection with each hair which springs from our bodies, there is a very remarkable contrivance by means of which it is kept smooth, glossy, and pliant. It is furnished with two or more oil-glands which secrete a greasy fluid. Nature therefore supplies her own pomade, and when the scalp is healthy no other is required. In fact, I may say that artificial oiling in such cases is injurious, because when nature finds her work performed by other means, she is apt to become sluggish. The need of the hair in this respect is the stimulus under which she works. No better illustration of this could be given than that afforded by the examination of two heads of hair, one which is washed daily, and another which only makes the acquaintance of water at long intervals. The first is always smooth and glossy; the second, unless some artificial pomade be applied after the washing, remains for some time dry and intractable. When the hair is worn short therefore, and the scalp is healthy, it should be immersed daily in cold water, but no soap should be used, as this would be too severe a strain upon the resources of the oil-glands.

The oil-glands are of a very simple construction. Each consists of a little sacculated pouch which opens into the hair-follicle, near its orifice, by means of a short duct or channel of exit. The oily matter, therefore, which is formed within the gland is discharged into the hair-follicle, and thus upon the surface of the hair. In every respect analogous with these oil-glands, so plentifully scattered through the human skin, is the large oil-gland which is situated in the bird at the base of the tail. You have all seen a bird pruning its plumage—carrying its beak backwards and forwards from this gland and lubricating its feathers with the secretion.

The glands in the eyelids are very large, and the secretion

* Several years ago the late Dean Stanley informed my father (the Rev. Dr Cunningham of Crieff) that a door in Westminster Abbey had a similar covering.

which they emit greases the margins of the lids and prevents the tears, unless copious, from trickling over the face.* In the ear passage the secretion is commonly called the "wax." It is yellowish in colour and intensely bitter, so that with the hairs in this locality we have a formidable barrier interposed against the intrusion of insects.

Hairs are likewise provided with muscles. These consist of slender bands of contractile tissue which cross the obtuse angle which is formed by the hair-follicle and the surface of the skin. On the one hand this little muscle is attached to the superficial part of the true skin, and on the other to the lower end of the hair-follicle (Fig.1). In passing between these points it partially embraces the oil-gland. And now let us see how it acts. In the first place it is not under the control of the will, but cold and certain emotions, such as horror and fear, at once call it into play. In such cases the hair muscles contract. They straighten the hair-follicles and erect the hairs. The well-known condition of goose-skin is the result. When a thrilling ghost story is told "the flesh creeps," or when a sudden ghastly apparition presents itself our hair shows a tendency to stand on end. All this is due to the contraction of the hair-muscles. In illustration of this I cannot do better than show you the admirable representation, by Sir Charles Bell, of a countenance expressive of fear.

In addition to their action upon the hair-follicles, the hair-muscles exert an influence upon the oil-glands. As we have seen, they partially embrace these. Consequently when they contract, they subject the glands to pressure, and help the flow of the secretion into the follicle.

Hair-growth.—I have spoken of the hair-follicle as the laboratory in which the manufacture and continued growth of the hair is effected. The building material is close at hand. At the bottom of the follicle is the little papilla upon which the bulb of the hair rests, and this papilla, as we have seen, is permeated by minute blood-vessels. In the same manner that our rivers and

* In addition to these large glands the eyelashes have special glands of their own in connection with their follicles.

canals carry bricks, mortar, and wood for the construction of our houses, so these blood-vessels convey to the hair-bulb the material necessary for hair-growth. Additions are therefore being continually made to the base of the hair through the greater part of its life, and as it rises up in the follicle, its upwardly directed scaly covering sweeps before it the scales which line the follicle. The scales which are thus carried to the surface constitute a part of the scurf of the head.

In its first formation the young hair usually passes upwards through the follicle with its point bent upon itself like a loop. This gradually forces itself through the orifice of the hair-follicle, and then the hair straightens itself by means of its own elasticity. Sometimes, however, the mouth of the follicle is closed by a plug of hardened greasy matter from the oil-gland, or, it may be, by a collection of scales from the scarf-skin. In such a case the growing hair may be unable to force a passage, and as it continues to elongate, it coils itself up like a watch spring inside the follicle. In time it produces an itchiness which calls our attention to the predicament in which it is placed, and we proceed to liberate it.

But when we are discussing the phenomena of hair-growth, you may very naturally ask, At what rate does hair grow and what length does it attain? The first part of this question is very difficult to answer, because so many circumstances influence hair-growth. In young people it grows much more rapidly than in people of advanced age, and in the same manner the earlier part of a hair's life is more active than the latter part. The time of the day and the season of the year are also considered by some to have an effect on hair-growth. Thus it is said to grow faster during the day than at night, and during the summer than in winter.

The average growth of the beard has been computed to be $6\frac{1}{2}$ inches each year. A man of eighty years of age, therefore, who has shaved regularly all his life may be said to have sacrificed to the razor about 35 feet of hair.

In the case of the head-hair the greatest discrepancies exist in

the results obtained by different observers. I shall, therefore, limit myself to the statement that in young females who have lost their hair by fevers, it has been observed to grow at the rate of 7 inches each year.

When the growth is good the average length of hair on the female head will be found to vary from 22 inches to 28 inches. Anything beyond this must be regarded as exceptional. Cases, it is true, are recorded in which it has measured from 5 to 6 feet, but these are very rare. When compared, however, with the hair-growth of the North American Indians, even this falls very far short. A chief of the Crows is mentioned by Catlin as possessing hair of the almost incredible length of 10 feet 7 inches. It is only on occasions of ceremony that an American Indian allows his hair to hang exposed. As a rule it is carefully rolled round with a leathern strap, and when thus done up it weighs several pounds.

In our own country custom does not permit man to vie with woman in the growth of the hair of the head. If the contest did arise I fear that man would be left very far behind. Some of you might wickedly insinuate that in the race unfair advantage might be taken by the fair sex: for not to refer to their Delilah propensities, their power of appropriating what does not belong to them in the way of head gear might be called into play. But to be honest, we must admit that the male scalp does not possess such rich gifts as a hair-producing organ as the female scalp. And for what reason? I would tire you were I to go into the various causes ascribed. Most of them are unsatisfactory. Let me give you one or two examples:—(1) that it is due to so much hair-making material being abstracted from the blood in man for the manufacture of the beard;* (2) that it is due to the mental labours of man being of a more severe kind; (3) that hair finds in the female scalp a more congenial soil for its development and growth, owing to a supposed greater amount of fatty tissue under the integument of the head.

* When we remember the beardless American Indian and his enormous power of hair-growth on the head there really does appear to be some grounds for this belief.

To my mind the most reasonable explanation is that of conjugal selection. Bald women have an undoubted difficulty in procuring husbands, and therefore their defect is less frequently transmitted than in the case of bald men, to whom the ladies do not seem to object, and who by a curious coincidence rarely transmit a deficiency in hair-growth to their daughters.

I have told you of cases in which the hair of the head grows to an exceptional length. The beard also occasionally takes on an unwonted activity. The most of my audience have no doubt heard of the sad fate of the worthy burgo-meister of a small town in Holland, who whilst hastily ascending the stairs leading to the Council Chamber, tripped upon his beard and was killed by the fall. I show you also the photograph of an American farmer, whose beard measured over 6 feet.

Life history of a hair.—We must now trace the biography or life history of a hair. The duration of hair life is limited, and sooner or later it is shed. Indeed it is stated that the hairs of an infant are completely shed within a year after birth; those on the body and limbs go first, whilst the hairs of the head and the eyelashes follow. This change may be carried on almost unperceptibly, as the place of the falling hairs is taken by a second crop. The process of loss and renewal is very simple. The old hair is detached from the papilla, and soon another hair makes its appearance at the bottom of the same follicle, and grows towards its orifice. The detached hair is thus gradually thrust out and shed. It is not at all uncommon to see the two hairs—the young and the old—projecting from the mouth of the same follicle. The whole process then is somewhat similar to the replacement of the milk teeth in the child by the permanent teeth.

The second crop of hair which appears is perennial. Each hair has been calculated to remain attached from two to six years. Before it dies, provision is made for its successor, and so this process of shedding and renewal goes on continually.

During its life a hair is only capable of growing a certain determinate length. The circumstance which determines this length is the amount of nutritive material which can be drawn

from the blood-vessels of the papilla. This being the case you will readily understand why a hair which has reached its full length on being cut will again resume its growth until, for a second time, it attains its typical length.

There is thus a continual and normal loss of hair constantly taking place, and it is only when the loss exceeds the powers of renewal that a tendency to baldness results. In the case of the female head, the daily loss may contain a quarter of the hairs shed of a length under six inches without giving rise to any apprehensions; should the number of fallen short hairs exceed this proportion the hair-loss is then abnormal—hairs are being shed which have not attained their full length, and the renewal will not keep pace with the loss.

As I have already hinted, baldness is much more common in men than in women, and I have also alluded to the curious coincidence that a bald-headed father does not as a rule transmit his defect to his daughters. So common indeed is baldness in the male sex, that it is rare to see a man over fifty with a good head of hair, and how frequently do we see comparatively young men with a shining pate. From the earliest times we have records of bald people. We are told in the Bible that forty-two little children were torn to pieces by two bears for mocking the bald head of the prophet Elisha, which seems to indicate that baldness was then rare and a subject of ridicule. Further, there is a tradition to the effect that the great dramatist, Æschyllus, met his fate by an eagle mistaking his smooth crown for a stone, and letting drop a turtle upon it in order to break the shell, but the shell proved harder than the tragedian's skull.

I have stated that I believe the greater luxuriance of hair on the female head to be largely due to the influence of conjugal selection. The converse of this, viz., that the tendency to baldness in man is due to the same cause, could not be entertained for a moment. No one would go so far as to assert that a smooth head is ornamental or a feature which would aid man in his matrimonial projects.

It is indeed difficult to account for this greater predisposition in

man to premature loss of hair. It is in a high degree hereditary. In a few cases it may be due to early dissipation, and in some other instances it may be due to an imprudent life led by some ancestor. Far be it from me even to hint that this is the usual cause. No doubt mental worry and strain have a powerful effect in producing it; and the absurd form of hat which fashion has for so long a time condemned us to wear, must also be highly detrimental to hair-growth. Both silk and felt hats, by their stiff, hard margins, exercise a constricting influence around the head and compress both the blood-vessels and nerves of the scalp. In addition to this, they are seldom provided with proper means for ventilation, and therefore prevent that free evaporation from the scalp which is so essential for the health of the hair and its follicle.

It is the custom of several races to produce artificial baldness by shaving the head. The Chinaman is perhaps the best example of this. He shaves the hair from the forehead and temples, and leaves only a circular patch which he allows to grow into a tail. The Andaman Islanders shave almost the entire surface of the scalp, as thoroughly as the imperfect implements at their command will allow them. Formerly they used chips of broken flint for this purpose, but since the arrival of Europeans upon their islands they can indulge in the luxury of a shave with a piece of broken bottle-glass. Such being the character of the razor you will not be surprised to hear that a wife takes a peculiar pleasure in shaving the head of her husband.* In our own country a shaven crown was formerly the badge of priesthood. "Towards the close of the fifth century it began to be regarded, both in the east and the west, as a necessary mark of the sacerdotal caste; and now the barber's razor was required to co-operate with the bishop's hand to constitute the priest. Two modes of shaving the clerical crown—the circular and the semi-circular—came into use; but who were the inventors of them? History, with blameworthy carelessness, has neglected to record. The Roman clergy gave

* Letter from Lieut. Casey, R.N., at present stationed at Port Blair, Andaman Islands.

a preference to the circular shave, which was and is performed by making bald a small round spot on the very crown of the head, and leaving it encircled by hair. The Scottish monks, on the other hand, adopted the semi-circular mode, and shaved the forepart of their head from ear to ear, in the form of a crescent." *

Greyness of the hair.—When speaking of baldness, we may as well refer to the change of colour which the hair undergoes as age advances. This is a natural and physiological process; but it may be greatly hastened by trouble and severe study. In many cases, the premature blanching of the hair is hereditary, and not to be accounted for by any cause for which the individual himself is responsible. It is an old belief that those who turn grey early, die early. Allow me to contradict this assertion most emphatically. There is no foundation for it whatever.

Under ordinary circumstances the change takes place gradually. It commences, as a rule, on the temples, and travels towards the crown. Ultimately it involves the whole head. Parti-coloured hairs may be frequently found: of these it is usually the basal portion which is white while the terminal part retains its colour. This is an interesting fact, because it shows that the change may occur during the life of an individual hair.†

But what produces this condition of hair? Two factors would seem to be at work, viz., (1) a loss of the power to produce pigment; (2) an increase of air in the shaft of the hair.

Up to the present I have merely referred to the gradual change of colour with which we are all familiar. Sometimes, however, it occurs suddenly—in the course, perhaps, of a few hours. Many cases of this kind have been recorded by thoroughly reliable witnesses. Fear, overpowering grief, and other strong emotions, are the agents which bring about this remarkable result. We

* "Church History of Scotland," by John Cunningham, D.D.

† Brown-Sequard made some very remarkable observations upon his own beard whilst it was turning grey. He marked certain of the coloured hairs and kept a constant watch upon them. He states that in some instances an entire hair would turn grey in the course of a night.

have all heard how the auburn hair of Maric Antoinette turned grey in a single night, and the same change is said to have occurred in Sir Thomas Morc the night bcfore hc was executed. Perhaps the most striking case is that related by Surgeon Parry. He states that he saw the jet-black hair of a rebel Sepoy, whilst under examination and stupefied by fear, turn grey in the course of half-an-hour. Let me give you one other instance. A gentleman, forty years of age, with dark hair, left home on his bridal trip. On his return he was hardly recognisable. His hair, and even his eyebrows, had in this short space of time become snow-white.

It is difficult to give any reasonable explanation of these sudden cases of hair blanching. No more powerful argument could be used for the vitality of the hair and its permeability by fluids. Still it is hard to conceive how in so short a time the colouring matter in the hair could be destroyed. It has been suggested by one writer that it is effected by the permeation of the hair by an acid fluid. Others again consider that the pigment remains unchanged, but that the whiteness is produced by an increase in the quantity of air in the hair-shaft. That the pigment remains unaltered in the first instance is rendered likely by the sudden blanching of the hair over a localized area, which sometimes accompanies severe attacks of neuralgia. In such cases the hair in a few days regains its natural colour.

Hair as a race-character of the human species.—Before concluding I must say a few words upon the value of the hair as a race-character. It must be clear to every one that the colour cannot be regarded as a character of much moment in this respect. There is no one special colour of hair peculiar to any one race. Indeed, in our own country we may see every hue, from the fairest flaxen to the jettest black. Mr Sorby has shown that the colour of the hair is determined by the presence in the hair of three or four distinct pigments, and that all the varieties of tint are produced by variations in the relative proportions of these pigments. Some anthropologists are inclined to believe that the earliest men who peopled the globe were red-haired, because amongst all human races individuals have been observed whose hair more or less approaches to this tint.

Independently of colour, however, there are characters present in the hair which separate many of the races of man widely from each other. In the Americans, Chinese, Japanese, and natives of High Asia, the hair is long, straight, and harsh like a horse's mane. Amongst the Negroes, Hottentots, and Papuans it is crisp and woolly. Between these extremes we may place the Europeans, in whom the hair is wavy and flowing.

This marked difference in the hair of these races depends in a great measure upon the contour of the hair shaft. The straight, stiff hair of the American or Japanese is cylindrical, and when

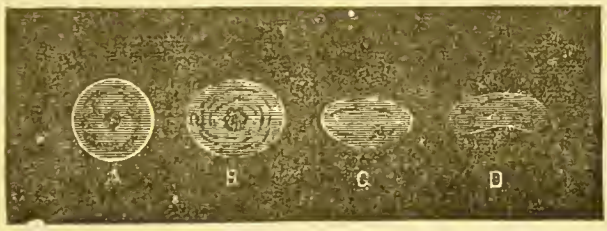


Fig. 5. Transverse sections of hairs of four different races.
A. North American Indian.
B. English.
C. Negro,
D. Papuan.
They are not drawn to scale, and the English hair therefore appears much too large.

cut across, the section appears circular. The woolly hair of the Negro and Papuan is flattened and tape-like, and shows an oval outline when cut transversely. The hair of the European holds a middle place in this respect, and presents a slightly oval figure when seen in transverse section.

Here then is the reason why in certain individuals the hair is curly, and in others lank and straight. It is simply due to a difference in the contour of the shaft. A circular shaft causes the hair to lie smooth and straight, whilst an oval shaft give rise to waviness or curling, according to the degree of flattening it presents.*

* The close curling of the negro's hair would also seem to depend upon another factor. In the negro scalp the hair-follicles are curved, which doubtless would tend to produce a spiral twist in the hair.

In Brazil there is a tribe called the Cafusos which has sprung into existenco by crossing between the long, stiff-haired natives and the imported negro slaves. As might naturally be expected from the admixture of these extremes, this people possess hair of a very extraordinary kind. It rises perpendicularly from the head in close curly masses, and forms a wig of such enormous dimensions that the possessors must stoop low when entering their huts.

I had intended, at the close of this lecture, directing your attention to some of the methods employed in dressing the hair in different countries, and had prepared for this purpose some lantern slides as illustrations. My time, however, is already exhausted. If you will allow me I shall therefore merely show you the slides, and let them speak for themselves. In many countries the care which is taken of the hair and the ingenuity which is displayed in dressing it is very extraordinary. In Canton in 1858 the number of Chinese barbers is said to have exceeded 7000. Most of the Fijian chiefs employ a hair-dresser whose whole duty is centred in the care of his master's hair; in the Latooka tribe it takes seven or eight years to complete the head toilet. As a general rule, in uncivilized countries it is the men who thus adorn themselves. In Marquesas Islands, indeed, the husband sometimes sacrifices his wife's hair towards his own adornment. He shaves her head, and appropriates her hair for his own crown.

In finishing, I may remark that I suspect that your criticism of this lecture will be, that whilst you have heard a good deal about "the hair" you have been told very little about its management, and still less about the diseases to which it is liable. I have refrained from entering this field for two reasons. In the first place, these points were dealt with in a very able lecture delivered to you by Dr Jamieson two years ago; and in the second place, my experience in these matters is very limited, and I did not wish to speak to you on topics outside my range of study. My aim has been to make you acquainted with hair-structure and the phenomena of hair-growth, and I may say in one sentence that all proper management of the hair must be founded upon this knowledge.

MARKETING AND COOKERY.

By Teachers from The Edinburgh School of Cookery and Domestic Economy, Superintended by The Honorary Secretary of the School.

The Health Society in applying to the School of Cookery for a lecture on this subject, has thereby given practical recognition of cookery as a means of promoting or of marring health. This great department lies almost entirely under the control of women, and it therefore seems a fitting subject for a lecture from women to women. In addressing you to-night we may say that the simple teaching offered is specially addressed to those poorer working women who, with small means at their disposal, and little apparatus to help them, are yet anxious to provide wholesome though inexpensive food for their families.

From these we must ask attention to three very important points, *forethought, economy, and ready-money payments.*

When you receive the weekly money you should plan out what your week's dinners are likely to be, fitting one with the other so as to have less cooking to do on the washing day or cleaning-up days. The articles that keep well should be bought in half pounds or pounds, so as to save the constant loss of time in running for little quantities.

Then there must be economy, which means not only saving but wise spending; and while, on the one hand every crust and bone should be turned to use, you can also be economical by laying your money out on the kinds of food most likely to keep your family well-fed and healthy.

Then as to paying ready money, this habit not only enables you to look about till you find the best article you can get for your money,—and a good housewife should know when she gets her money's worth,—but it takes away that terrible temptation to get something extra just because it may go down in the bill. With small means, if you wish to keep out of debt be sure to pay ready money, for then you know exactly how far your money will go.

We propose to-night to cook a few dishes to illustrate different classes of food

Butcher's Meat.

Good meat is known by certain signs. It should be a deep red colour, the flesh firm, and when pressed with the finger no mark should remain. It should have a fresh smell, and should not become moist when kept. The fat should be pure white, and in the finest pieces of beef the fat should be mixed in the lean in delicate threads. You should not buy meat that is pink or dark purple in colour, that has a sickly smell, or that is offered under the usual market price. The cheaper pieces of meat may be made into wholesome dishes by slow cooking, either boiling or stewing, and with certain additions may be made wholesome, economical, and savoury. We shall now show you the

Health Society Stew.—Required 1 lb. of stewing beef, one onion, one small carrot, half a turnip, one tablespoonful of vinegar, three breakfast cupfuls of cold water, one tablespoonful of flour, pepper and salt. Cut the meat into small pieces, put them into an iron saucepan with the onion (skinned and cut in slices), and sprinkle over these the pepper, salt, and vinegar. In a basin add the water gradually to the flour, stirring to prevent it from going into lumps, pour this over the meat. Place the saucepan over the fire, and stir till nearly boiling. Pare the turnip (the coarse fibre on the outside is indigestible), scrape the carrot, and cut both into neat pieces and add them. For those who find onion heavy, it is an improvement to pour boiling water over it when

skinned and let it stand for ten minutes. The addition of a piece of soda the size of a pea draws out even more of the indigestible part of the onion. Put the lid on the pan, and let the stew simmer gently while you make the balls.

If you had a suet dumpling for dinner yesterday, you might lessen to-day's work by making a little more dough than was wanted for the dumpling, and putting it aside for to-day's balls. The dough swells a little, and will go further if prepared one day and used the next.

Balls.—To four tablespoonfuls of flour, allow two tablespoonfuls of finely chopped suet, a pinch of salt, and a little water. Put the flour, suet, and salt into a basin, and when they are well mixed add enough cold water to make a dough, divide this quantity into four, flour your hands, form into small balls free from cracks, and throw them into the stew. Let it cook by the side of the fire with the lid on till tender; this will take about two hours altogether, longer if the meat is tough or gristly. Small pieces of meat are more quickly cooked than large.*

To simmer gently and to cook for a long time are the great secrets of making a tender stew. A little vinegar not only improves the flavour, but helps to soften the fibre of the meat.

Fish.

Fresh fish should be well covered with scales, the gills should be a bright red colour, the body stiff, the eyes bright and prominent. Many people prefer cod and ling after it has lain for a night covered with salt; this makes it firmer. At ordinary prices, a fresh herring is the cheapest and most nutritious of fish for the money, and can be prepared for eating in a great many different ways.

White fish is considered to be the lightest and most digestible. Be sure you save the liquor the fish is boiled in; with this, and

* As this dish will not be sufficiently cooked within the lecture hour, we have already prepared exactly the same ingredients which have been cooking, in order to be ready at the end of the hour.

with the boiling of the bones, skin, head, and fins, you can make various good soups.

We shall now suppose that you have had boiled cod for dinner yesterday, and a little has been left over. This we shall turn into

Fish and Cheese.—Required 1 lb. cooked fish, ¼ lb. macaroni, 2 oz. grated cheese, pepper and salt, half-a-pint of sauce, a small piece of dripping or clarified fat, a few bread crumbs. Cook the macaroni by putting it into hot (not boiling) water, with a little salt, leaving the saucepan uncovered. Allow the macaroni to boil for twenty minutes, till it is quite soft and swollen, drain the water off, and chop the macaroni into small pieces. Grate the cheese. Grease a pie-dish, put in it a layer of fish, then some macaroni, then sauce, and sprinkle some cheese over it, and the same again till all is used. Cover the top with bread crumbs and a few morsels of dripping. Brown it in the oven or before the fire. As everything in this dish is cooked, it only requires to be warmed through and browned. Instead of macaroni you can use cooked rice, potatoes, or bread crumbs.

If this is a busy day, you have probably made a little more sauce yesterday than you required for the boiled cod, and have put it aside for to-day's dish.

The sauce is made thus :—

Sauce.—Required 1 dessertspoonful of flour, a piece of dripping the size of a small egg, a breakfast cup of the liquor the cod was boiled in, a pinch of salt.

Put the dripping into a small saucepan, let it melt but not get hot. Add the flour and mix all with the back of a spoon. Then add the liquor very slowly, a little at a time, stirring continually to prevent the mixture going into lumps. Stir over the fire till the sauce boils, boil well up for about three minutes, when it is ready for use.

This is the way all melted butter sauces are made, from this very cheap substitute up to the richest preparations. The sauce may be made richer by using butter instead of dripping, and milk instead of the fish liquor, and chopped parsley, or various flavourings may be added, but for this sauce, in whatever form you make

it, you must be sure (1st) that the fat and flour are well mixed together; (2nd) that the cold water is added very gradually and well stirred; and (3rd) it must be thoroughly boiled.

The Pulses.

The late Sir Robert Christison, whose name will always be remembered with honour in Scotland, took a warm interest in our School, and gave us much useful advice. One of his written remarks was, "When people can afford little or no animal food, be sure you preach pulses and porridge." So, leaving porridge for later reference, we now in his name "preach pulses." These consist of lentils, peas, and beans, and are too little used in this country as a substitute for animal food. They contain the same kind of nourishment that animal food does, and in Egypt and India are used much by the natives in its place.

Lentil Soup.—Required 1 lb. of lentils, two onions or leeks, a piece of carrot and turnip, a piece of dripping about the size of an egg, about ten breakfast cupfuls of water, pepper and salt.

Wash the lentils well till they are quite clean. Let them soak over night in the water, to which add a piece of soda about the size of a bean. They require less time to cook when thus soaked. About two hours before dinner put the lentils and water into a saucepan, and when it boils, add the onions, turnip, carrot, skinned, pared, and scraped as you saw in the stew recipe. They should be chopped very small, to enable them to cook more quickly. Also add the dripping, and allow the whole to boil for about two hours, skimming very carefully from time to time. Then strain it through a colander, rubbing the lentils and vegetables all smooth, but keeping back any skins or husks. If you have not a colander, pour the thin part of the soup off first, and rub the rest smooth with the back of a wooden spoon. Return it all to the pan to warm; season with pepper and salt, and serve with toast cut into small square pieces.

Lentil soup is very nourishing, and does not require any meat or bones. You can vary it by adding a little curry or mustard, and serving with plain boiled rice. The great French cook,

Soyer, used to say that all vegetable soups are improved by the addition of a little vinegar and brown sugar.

The cheapest, and in some respects best kind of lentils are the Egyptian. They, however, have a good deal of earth about them, and require much more washing than the split red lentils, which resemble split peas in appearance.

A dish that Sir Robert Christison specially recommended to us is made of well-boiled lentils, surrounded by boiled rice, and covered with melted butter, to which a little chopped parsley has been added.

There are many ways of cooking lentils, peas, and beans. All of these may be made into soups of various kinds, or may be added to broth or other soups. Peas make a capital dish in the shape of peas-pudding, which is taken with pork. Pease-brose and fat pease-brose (the latter being ordinary pease-brose with the addition of some dripping) are admirable and nutritious dishes, with the additional recommendation of being quickly and easily prepared.

Beans, either broad or haricot, may be served as a vegetable when plainly boiled, or with parsley sauce over them, and they should always accompany boiled bacon. Or, after being well-boiled, and the water allowed to drain away, they may be tossed in a frying-pan with fat bacon cut into small pieces.

It is not in our department to give you the arguments for and against vegetarianism, but a few facts which are well established may be of practical use to you.

1st. Pulses are not so easily digested as animal food, and are, therefore, more suited for those who have good digestion than for the weakly.

2nd. Pulses are more digestible when taken with even a small amount of animal food, than when taken alone.

3d. When fat or oil is taken with them, they are also more easily digested than if eaten alone.

VEGETABLES.

"The pulses" are vegetables, but those we shall now speak of are more commonly called garden vegetables.

The potato is our most valuable and commonest vegetable, and one which can be cooked in a great variety of ways. For plain boiling, it is best to cook potatoes in their jackets or skins. This skin consists of something like thin cork, which keeps all the good in the potatoes while they are cooking. There is in most garden vegetables, but especially in the potato, a substance called salts of potash, which is very valuable in strengthening the bones, in keeping the blood pure, and in preventing scurvy and other kinds of suffering. It is said that after the potato was brought to England by Sir Walter Raleigh, the plague disappeared, and scurvy became greatly lessened. This is believed to have been chiefly in consequence of the use of the potato; so you see how important it is not to lose more of those salts of potash than can be helped. When the potato is pared before cooking, about half of those salts of potash escape into the water and are lost.

Boiled Potatoes.—Choose potatoes of an equal size, in order that they may all be ready in the same time. Wash and brush them well, and pack them closely in an iron saucepan. Cover with cold water, and add a little salt. Put the lid on the pan, place it on the fire, and as soon as it boils, draw a little to one side, and let the potatoes cook gently until nearly soft. If they are boiled too quickly, the outer part will be broken and soft before the middle part is cooked enough. When the potatoes are sufficiently soft to be pierced by a fork, pour off the water, draw to the side of the fire, and cover them with a clean cotton cloth, which will absorb the steam and finish the cooking. In about fifteen minutes they will be ready. The length of time that you boil potatoes depends on the size, age, and quality you use. Large old potatoes take the longest. Those grown in sandy soil are the finest, and keep their colour best when cooked. The potatoes I am cooking will take about twenty minutes.

As an iron pan is in every house, we have shown you the simplest way of cooking potatoes; but a still better way is to cook them in a steamer. A steamer can be made to fit any pan; it has holes in the bottom of it, through which the steam from the boiling

water in the pan passes, and cooks the potatoes without their coming in contact with the water. This large steamer cost half-a-crown, and is fitted to the pan. When potatoes become old and not so good, it is advisable to pare them before boiling. When you do this, you must be most careful to pare the skin very thinly, because the best part of the potato is next the skin. An old pointed knife is most convenient for this, and for taking out the eyes.

As a rule, garden vegetables should be as fresh as possible, but potatoes, carrots, and turnips will keep for some time; so will cabbages in frosty weather. If, however, a cabbage is frozen, you must be careful not to plunge it into boiling water, but to put it for some time into cold water to allow it to thaw.

To boil a Cabbage.—Remove the coarse outer leaves, which are indigestible. To get rid of earth and insects, put the cabbage in plenty of cold water for about twenty minutes or half-an-hour, and shake it well; if you have some vinegar you can spare, add a tablespoonful. The old way of adding salt to the water is now found not to be quite satisfactory, because though it does remove the insects, there is a slimy substance left from them on the cabbage. Have a saucepan ready, with thoroughly boiling water in it. Put the cabbage in this, and see that the boiling water covers it. After it has boiled five minutes, pour off this boiling water and pour fresh boiling water over the cabbage. This is a great improvement to all green vegetables if at all old or coarse. Let the water boil very fast, with the lid off, for about half-an-hour to three-quarters of an hour, till the stalk end of the cabbage is soft. Old and large cabbages require longer boiling than young and small ones. When ready, place it in a colander or in a plate, and press with a plate to squeeze out the water.

There is a capital dish you can make with any potatoes and cabbage that may be left over.

Colcannon.—Required equal quantities of cold potatoes and cold cabbage, about 1 oz. of dripping to 1 lb. of vegetables, a piece of dripping to grease the basin, pepper and salt. Crush the potatoes with a fork, chop the cabbage small, mix both

together and put into an iron saucepan or a frying-pan, with the dripping, pepper, and salt. Stir over the fire till the dripping has melted, and mixed well with the vegetables. Grease a basin, put the mixture into it, and place the dish in a hot oven or before the fire for about twenty minutes.

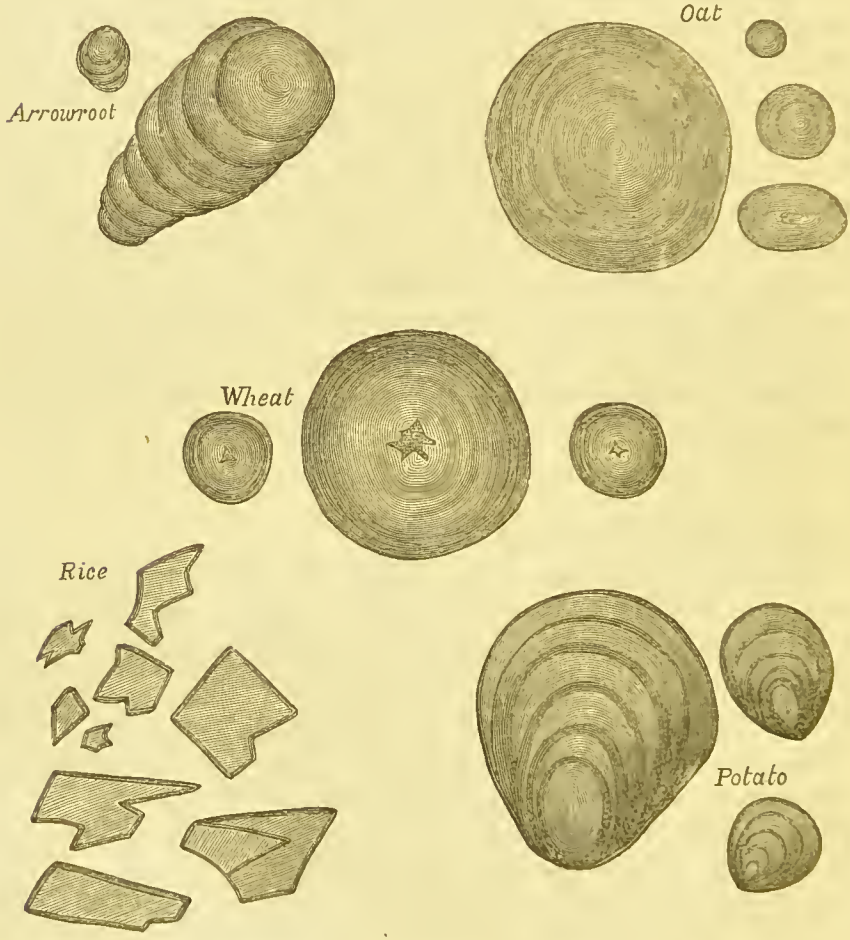
It is very important to have fresh garden vegetables as part of our food, and you should be careful to supply these for your family's use. There is no more excellent way of giving them than in our fine national dish, Scotch broth. Made with barley, a little dripping, fresh vegetables chopped and well cooked, some grated carrot, a little brown sugar, pepper and salt, it is an admirable dish. If you live in the country, you can use young nettletops in spring instead of cabbage. Of course a sheep's head or piece of meat will make it stronger, but you get a nourishing good dish without, and one which is only equalled by our equally celebrated, but now, alas! too much neglected dish—porridge. And this brings us to the general group of foods under the name of

Groceries,

which we shall illustrate by a

Rice Pudding without Eggs.—Required one tablespoonful of whole or broken rice, 1 oz. shred suet, dripping, or butter, one dessertspoonful of sugar, half pint of skim milk, a pinch of seasoning (nutmeg, ground ginger, cinnamon, or allspice). Wash the rice by pouring water over it, and then pouring it away several times, until the last water is pure. Shred the suet by scraping it into thin slices with a sharp knife; put half of the suet into a pie-dish; over this put the rice, sugar, and seasoning. Then pour in the milk, and put the rest of the shred suet on the top. Place this in a cool part of the oven, and let it cook very slowly for about an hour. If you let this cook at all quickly the milk will dry up, and you will need to add more. It is long, slow cooking that is needed, to allow the rice to swell, and take in the milk. This is an excellent dish for young children, who, after the age when they get milk alone, should have various kinds of milk puddings.

For these it is best to use hominy, semolina, macaroni, barley, rice, and ground rice, as they contain more nourishment than sago, tapioca, corn-flour, or arrowroot. With all of these you must be most careful to cook them long and thoroughly. There is a great deal of starch in them, and unless they are first mixed



with cold liquid, and every little grain of starch is allowed, by slow heat, to swell, soften, and burst, it is indigestible, and likely to cause suffering, especially in young children. This diagram will give you an idea of the difference of size between the uncooked and the cooked grains.

You should not buy flour in very small quantities, as it is all the better of being kept for a short time, to allow it to become drier. Good flour should be soft to the touch, not gritty, and should not have the slightest musty smell.

We shall now "preach porridge." When you are at the grocer's be sure you lay in a supply of oatmeal; in buying it you get, of all our foods, the best return for your money. There is not a dish in the world to compare to porridge and milk for making the body firm and healthy, for giving you strength to work with, and warmth to resist the cold. But you have difficulties, some one may say. When the husband goes out at six o'clock in the morning, it is difficult and expensive in a winter's morning to have the fire on and the porridge cooking for half-an-hour. In answer to this, we may tell you that a London doctor, who is making a special study of food, tells us that porridge is really more wholesome and digestible if made one day before and warmed up. But if you don't like this, and we can't recommend it, you can at least give the "gudeman" a plate of freshly cooked porridge for supper when he comes home, varying it occasionally by pease-brose, some soup, or other warm nourishing dish.

Then the children, you say, get tired of porridge. No doubt in this as in all other foods you need variety, and you must remember that our usual Scotch way of cooking porridge is apt to be heavy for children. Our usual tasty way of cooking porridge is to slowly sprinkle the meal in handfuls into boiling water, add salt to taste, and let it boil about twenty minutes, stirring well; eat it hot before it becomes stiff. It is somewhat more digestible however, though less palatable, if the meal is mixed well with cold water, and then slowly boiled.

On the mornings when the children do not get porridge, do not give them tea, as it is very hurtful to their nerves; give them milk and hot water to drink. Indeed, when we are at the grocer's, it would be a very good thing if sometimes we should forget to buy tea for ourselves. Every woman knows the comfort of a good cup of tea, but doctors tell us that, while all women are apt to indulge rather too freely in "the cup that cheers, but not

inebriates," much of the indigestion, weak nerves, and white faces among our working-women especially is caused by using what is merely a refreshing drink as a *substitute* for food. Remember that we may stop hunger without feeding the body, and we may train ourselves in good habits in food, as in other things.

Milk.

As our time is short, we must make the rice pudding also the text for a few remarks on milk. Many of you will remember Mr Chiene's remarks upon milk and the dairy.* He told you that milk is a sponge, and a dangerous sponge—that it absorbs at once any hurtful matter, and is one of the most fertile sources of epidemics. "No milk shop should have any connection with an inhabited house, there should be no possibility of sewer gas reaching the basins of milk. . . . Keep a sharp look-out on your milk-cart, and see that it is not utilised for carrying pigs' meat." Having done your best to choose a clean dairy answering these requirements, you should, when you have limited accommodation for keeping milk, buy it as fresh as possible. If it must be kept in the kitchen or a sleeping-room, be sure that the basin or jug is closely covered, always remembering that when the air is close or impure, the milk is sure to be affected by it. In hot weather, or when the milk has to be kept over night, it is often advisable to scald it to make it keep. Scalding is bringing the milk almost to the boiling point. If in doing this you find a skin form on the top of the milk, on no account throw it away. It is a very valuable part of the milk, and if you throw it away you deprive your children of something which helps to build up and strengthen their bodies. This kind of skin should be rubbed smooth with the back of a spoon and returned to the milk. You must also be especially careful that the dish milk is kept in is well washed in clean hot water and thoroughly scalded. Indeed in everything connected with food you must attend strictly to thorough cleanliness.

* "Civic Sanitation," by John Chiene, F.R.C.S.E. (*Health Lectures*, 4th Series.)

Bread.

There seems to be a considerable waste in many houses in the form of crusts, arising in part perhaps from giving the children a "piece" between meals. There are many ways in which these odd scraps may be used up. The simplest is to soak them in boiling water till soft, squeeze as dry as possible, and add some hot milk and a little sugar. This makes a wholesome meal for the children. Another way is to make

Goose Pudding.—Required about ¼ lb. of scraps of bread, one large or two small onions (previously well boiled), half a tablespoonful of flour, half a teaspoonful of sage dried and rubbed down, a piece of dripping about the size of an egg, two table spoonfuls of milk, salt and pepper. Soak the bread for an hour in hot water; squeeze as dry as possible; bruise the bread with a fork till it is smooth. Chop the onion finely; mix all the ingredients well together except the dripping. Grease well a baking tin, place the mixture in it, and put the rest of the dripping in small pieces on the top. Bake in the oven for half-an-hour. If you have no oven, put the tin on a hot hob or girdle for twenty minutes, then brown before the fire, turn out of the tin and cut into pieces. Serve hot or cold.

New bread is neither economical nor wholesome; it should always be used either one or two days old. We have all become so accustomed to use white bread, that many think the whiter it is the better it is. This is quite a mistake; bread made with seconds, whole meal bread, rye bread, all give a better return for your money than very white bread. You probably know that much has been done to improve the grinding of wheat, in order to provide this whole meal bread, which we are told by many is wholesomer as well as more nutritious than white bread. If you cannot adopt these darker breads entirely, at least remember that in bread, as in all other departments of food, variety is both tempting and good for the health.

You will find in an appendix to the printed lecture general directions for the different ways of cooking, viz., roasting, broiling, steaming, boiling, stewing, frying, and baking. Of these

roasting and broiling are no doubt the most savoury, but are only suited for the finer pieces of meat. Steaming is a most economical method, and should be much more used than it is. It requires very little fire; there is no waste of any of the materials cooked, and none of the liquid cooked can pass off in steam, as in baking and boiling. Stewing, as we have already mentioned, is the best and most economical method of cooking tough and gristly pieces of meat.

Bones are useful for making soup with. We have heard of one careful woman who boiled twopence worth of bones whole one day for soup; the next day she split them and boiled them again for more soup, and the third day she "just gave them a boil again to make sure that nothing was left in them."

To keep our bodies healthy and strong we must have variety of food. Dr Russell, in his lecture on "Food and Drink,"* explained to you fully what the different classes of food are, and the work each class has to do. It is therefore not necessary here to enter into those particulars again; it is enough for our present purpose to press upon you the great importance to health of variety in food, and of variety in the methods of cooking it. Good food is not necessarily expensive food. A great authority on food and diet—Dr Parkes †—writes: "A labouring man by ringing the changes on oatmeal, maize, peas and beans, rice and macaroni (which is made from corn), to which may be added cheese and bacon occasionally, may bring up his children as well nourished as those of the richest people, and at a small cost. Oatmeal, the most nutritious of the cereal grains, and formerly the staple food of our finest men . . . Indian corn . . . peas and beans, and rice are far less used by our poorer classes than should be the case."

One word in conclusion: the woman who does her marketing and cooking ignorantly and badly, as surely promotes indigestion, ill-temper, and dram-drinking, as the thoughtful and efficient cook undoubtedly promotes good health, good temper, and sobriety.

C. E. G. W.

* "Food and Drink," by Dr J. A. Russell.—"Health Lectures," 1st Series.

† "The Personal Care of Health," by E. A. Parkes, M.D., F.R.S. Published by the Society for promoting Christian Knowledge, price 1s.

APPENDIX.

GENERAL DIRECTIONS FOR COOKING.

From "The School Cookery Book" (Macmillan & Co., price 1s.), from which most of the preceding recipes are also taken.

ROASTING.

Meat for roasting should be kept hanging till the fibre becomes tender. The length of time required depends on the state of the weather and the season, ranging from a few days, or, in summer even a few hours, to three or four weeks in a dry cold winter. In frosty weather the meat must be brought into the kitchen for a few hours, before using it, to soften it. To ascertain the length of time required for roasting, weigh the meat and allow in roasting one quarter of an hour to each pound and one quarter of an hour over. If, however, the piece of meat is very thick, allow half an hour over. Young and white meat (veal, lamb, pork) require twenty minutes to each pound and twenty minutes over. They are unwholesome when underdone.

Sweep up the hearth, and make up a large fire in a well-polished fireplace an hour before it is wanted, so as to have it bright and glowing. Do not let the fire go down while the meat is roasting: add small pieces of coal or large cinders occasionally, so as to keep it up. Hang the meat by the small end to the hook of the jack. When there is no jack, the meat may be hooked to a skein of twisted worsted suspended from a hook projected from the mantel-shelf. Wind up the jack, or twist the worsted, so as to make it spin slowly. Place the dripping pan under the joint. If you have a meat screen see that it is bright (so as to throw back the heat upon the joint), and place it before the fire. Meat should be placed for the first ten minutes as near the fire

as can be done without scorching, as the great heat hardens the outside, and keeps in the juices. Baste it as soon as the fat melts. Basting prevents the meat becoming dry and scorched. Then withdraw the meat 15 or 18 inches from the fire, and baste it frequently whilst cooking with the dripping produced by the melting of the fat.

A lean piece of meat should be basted with hot dripping melted for the purpose. The meat may be dredged with flour a quarter of an hour before it is quite ready, to make it browner and to thicken the gravy a little. When it is placed on a dish (called in Scotland an ashet), sprinkle it with a little salt. Before making sauce of the brown gravy, pour away the dripping from the dripping pan (keep this dripping for other purposes), add a little boiling water to the browned gravy left in the pan, mix well, add a little salt, and pour round the roast.

Roasting in the Oven.—This is usually called *baking* meat. Place the meat in a baking-tin in a very hot part of the oven for five minutes to harden the outside and keep in the juice. Baste it as soon as the fat melts; then remove it to a cooler part; place beside it a cup or basin of *hot* water to keep the air of the oven moist without cooling it. Baste the meat frequently. For the length of time required, see preceding directions. All ovens in which meat is cooked should be properly ventilated in order to allow the escape of an injurious vapour produced by meat when cooked in a close oven. Meat rosted in the oven is not considered so digestible as when roasted before the fire.

Roasting in the Pan.—Melt and heat one ounce of dripping in an iron pan.* Brown all sides of the meat in this, so as to harden the outside and keep in the juices. Then draw the pan aside, and let the meat cook slowly with the lid on, basting it constantly. For the length of time required, see preceding directions. This way of roasting is especially suitable for small pieces of meat, and is economical because of the small quantity of fuel required.

*Tinning is apt to melt with the great heat and small amount of moisture.

BROILING.

Broiling is cooking over a hot clear fire on a gridiron. Place a thoroughly clean gridiron over the fire ; let it become quite hot, as the hot metal will help to harden the outside of the meat, and so keep in the juices ; rub the gridiron with suet to prevent the meat sticking to it. Place the meat on the hot gridiron, turn it continually, so as to let the inside of the meat cook slowly and so remain tender. Be careful to put the fork into the fat or skin. If you pierce the lean, you will allow the juices to escape. If tongs are used, do not squeeze the meat. The length of time required depends chiefly on the thickness of the meat to be cooked. A separate gridiron should, if possible, be kept for fish. When the top of the fire cannot be used (as in close ranges), suspend a hanging gridiron in front of the fire with the meat between the two halves of the gridiron, which must be turned with the meat.

STEAMING.

In steaming, the food to be cooked is placed in a tin or earthenware vessel, covered with a tight cover or greased paper.* The vessel is placed in a pan of boiling water, which comes half way up its side. If the water boils away, more *boiling* water must be added. Puddings, &c., when steamed, do not require to have so much liquid in them as when baked. The dry air of the oven dries them ; steaming keeps them moist.

BOILING.

Meat covered with water and cooked in it is said to be boiled, but it must not be supposed that the water should be kept at boiling point. Plunge the meat into boiling water (212° Fahr.), enough to cover it. This hardens the outside, and keeps in the juices. After the water (cooled by the meat) again comes to the boil, let it remain boiling for about five minutes, then skim carefully, and add cold water, or move the pot to a less hot place, till

* No printed paper should be used in cooking.

the water simmers instead of boils (about 170° Fahr.). Draw the pot aside, keep it at this heat till the meat is cooked, allowing a quarter of an hour to each pound, counting from the time the water begins to boil, and one quarter of an hour over. If it is a large piece of meat, allow half an hour over. Add a little salt when the meat is nearly ready.

For salt meat or pork allow twenty minutes to each pound. Salt meat is put on with cold water. For fish allow ten minutes to the pound, and, when thick, ten minutes over.

Green vegetables should be boiled briskly and without a lid on the pan : this helps to preserve the colour.

STEWING.

In stewing juicy meats the outside should be hardened by browning in order to keep in the juices. The meat is then placed in a stewpan and a small quantity of hot water or stock poured round it. This is slowly warmed and then allowed to simmer slowly, and must on no account be allowed to boil. Stewing chiefly differs from boiling in the quantity of water used, and in the length of time of cooking. The juice that is drawn out of the meat is served in the gravy.

Coarse pieces of meat may be made tender by careful and long stewing, but they should not be browned. If very tough, they may be dipped in vinegar to soften the fibre. Gristly pieces should be put on with cold water and simmered till tender, but not allowed to boil fast.

Another and a good way of stewing is to put the stew in a stone jar with a closely fitting lid, or cover of greased paper. The jar is placed on the hob, or in a slow oven, or in a sauce pan with water kept boiling round it.

FRYING.

Frying is cooking in hot fat. The ordinary but wrong way of frying is to use a shallow frying-pan and a small quantity of fat. This is extravagant and unwholesome. Put into a stew-

pan enough fat to cover the article to be cooked. Make the fat hot. It is at the proper heat when it is quite still and a slight vapour rises from it; do not wait till it smokes, for then it will burn. The fat may also be tested by putting into it a small piece of crumb of bread; if it becomes quickly a golden colour, the fat is at the right heat. Prepare the pieces to be cooked by covering them with a coating of egg and bread crumbs, or flour and milk, or flour and water. This covering hardens with heat, and makes a case to hold in the juices and also prevents the fat getting in and making the meat greasy. Do not have the pieces thicker than about an inch, unless the materials have been previously cooked. Put them into the hot fat, but not many at a time, as the fat would be too much cooled. Whey they become a golden colour remove them; place them for a few seconds on kitchen paper near the fire to absorb the fat, and then serve.

Oil, butter, lard, and dripping, or clarified fat, are used for frying. Oil and butter are very expensive, and should only be used in high class cookery; lard is apt to make what is fried in it greasy; dripping or clarified fat is the most suitable for use in an ordinary kitchen.

Dry Frying.—In dry frying a very small quantity of fat is used, and it is usually done in a frying-pan; the meat or vegetables should be frequently turned to prevent hardening. Bacon does not require fat at all, as its own melting fat is sufficient. Chopped vegetables, such as cabbages and potatoes mixed (the bubble without the squeak), are excellent food with a little dripping, and may be done in the frying-pan. Cold pudding may be cut in slices and fried in this way.

BAKING.

Baking is cooking by means of heated air in a confined space called an oven. Bread, cakes, and pastry are usually cooked in this way. As a general rule, anything containing starchy materials, as flour, arrowroot, &c., should, if not previously boiled, be first placed in a hot part of the oven to burst the starchy grains and

enable them to mix thoroughly with the surrounding liquid; they should then be removed to a cooler part, to cook slowly without scorching. If pastry is put at first into a cool part of the oven, the fat melts; but as the starch grains of the flour are not burst, they cannot absorb the fat, which runs out and makes the paste greasy and heavy.

The proper management of an oven must be the result of experience, as it is impossibe to give exact rules. A large brick oven gives the most steady heat. Iron ovens become easily overheated, and small iron ones are apt to scorch what is cooked in them unless carefully regulated. Therefore, bread should be divided into smaller loaves when baked in a small oven, to prevent the outside being browned while the inside is still uncooked.

To test an oven, put into it a piece of stale crumb of bread; if in five minutes it is a golden colour, the oven is hot enough for cooking pastry or bread; if, on the contrary, the bread becomes dry and only slightly coloured, the oven is of a moderate heat, and suitable for browning puddings, &c. Another test is to put a piece of kitchen or writing paper into the oven; if it curls up in about a minute, the oven is hot enough for baking.

Where there is no oven, puddings may be browned before the fire. Meat, puddings, and even pastry, may be cooked in a Dutch oven before the fire. Scones, oat-cakes, &c., may be cooked on a girdle (much used in Scotland) instead of in an oven.

ADULTERATION OF FOOD.

By J. FALCONER KING, F.C.S.,
City Analyst, and Lecturer on Chemistry, Edinburgh Medical School.

The subject of food adulteration, although it is one of a somewhat different nature from those which have already been treated of in this course of lectures, and although it is one perhaps to most people not very attractive, is seen when properly looked into to be one of very great importance indeed, and interesting not only to people in general, but specially interesting to and deserving the close attention of the financier, the sanitarian, and the moralist.

Notwithstanding, however, this my opinion, I freely admit that when first applied to by the Committee of the Health Society to deliver this lecture to you I had very serious misgivings as to the probable success of a popular lecture on such an unpopular subject as Food Adulteration. For it must be conceded that however valuable certain kinds of information may be, it is not at all times pleasant to hear of them, and I think this applies with a good deal of truth to the lecture of to-night, dealing as it does with the various forms of sophistication to which the food and drink we are daily partaking of is subjected.

Still on reflection I arrived at the conclusion that this may be a good instance of fore-warning being fore-arming, and that if dangers are to be encountered in this way, it can at least do us no harm to be told of their existence, their nature, and possibly of the means by which they may be avoided.

The practice of adulterating food seems to be a very old one.

In Athens in its palmy days, the adulteration of wine seemed to be carried to such an extent as to necessitate the appointment of a special inspector, and the duties of this early City Analyst seem to have been much the same as those pertaining to his modern counterpart. In Rome also we read that the wine, according to the records of Pliny, was adulterated to such an extent that even the rich could not get certain varieties in a state of purity.

Coming to a later date and nearer home we learn on good authority that in England, in the 11th century, the brewers, bakers, vintners, and pepperers, as dealers in drugs or spices were then called, were the chief sinners in the matter of adulteration.

Indeed about this time, so much did the trade of baker stand in need of regulation, that what was called an assize of bread was instituted. This was followed by the statute of assize, and although at first the main object of this statute was not the suppression of adulteration, as time went on the malpractices of bakers became so flagrant that clauses were introduced stating punishment for certain offences. Thus we read in the assize of 1582:—"If there be any that by false meanes useth to sell meale; for the first tyme he shall be grievously punished, the second tyme he shall lose his meale, the third tyme he shall foreswere the town, and so likewise the bakers that offend."

These were certainly rather smart punishments, and yet they were not by any means too severe for the abominable crime of wilful food adulteration. They are no doubt a little different to those which we mete out to similar offenders in our own time, and they serve to show in what righteous abhorrence this offence was held by the law makers of these early days.

As in our own day, the mode in which adulteration was effected by those pioneers in the art varied considerably. Sometimes, as with us, alum was added to flour or bread, but unless this was done very clumsily its detection, so backward was the then state of science, was by no means a matter of certainty.

Occasionally bread by a cunning device was made to look well outside when it was really bad within. And in an old record

we read the following account of a pretty severe punishment for this offence. A baker was sentenced to the pillory, having been convicted of making bread of what was good dough without but bad within, because such falsity redounds much to the deception of people who buy such bread.

Bakers, however, were not the only sinners. Besides them I mentioned brewers as tradesmen who were apparently justly suspected of evil practices in connection with the wares they dealt in. So strong, indeed, was the suspicion entertained by our forefathers that their ale was not altogether what it should be, that a set of men called ale tasters were appointed, whose special duty was to examine the ale sold, in order to determine its quality.

The mode of testing ale in vogue 300 years ago, we may well imagine was hardly so refined a process as that which we employ at present. It had, however, the undoubted merit of simplicity, and consisted first, as indeed the name of the body indicates, in tasting the ale. That process having been found to yield satisfactory results, the liquor was then tested to ascertain whether it had been adulterated by the addition of sugar. This test was carried out by the inspector first spilling a quantity of the liquor on a bench, and then with his leather breeches on, sitting down on it. If sugar had been added, the inspector after a time became so attached to the seat that to quit it was a matter of difficulty. If, however, the ale was pure and free from sugar, he after the lapse of the prescribed time rose from his seat with the usual facility.

The vintners also were suspected, and not without reason, if we are to believe Addison, of supplying the public with liquor, which, according to the phraseology of our present Food Adulteration Act, was "not of the substance, nature, and quality of the article demanded." In a half-humorous strain the genial writer of the "Spectator" thus refers to the attempts of these subtle philosophers, as he calls them, to manufacture wine without having recourse to grape juice. He says, "They are daily employed in the transmutation of liquors, and by the

power of magical drugs and incantations raise under the streets of London the choicest products of the hills and valleys of France. They squeeze Bordeaux out of a sloe and draw champagne from an apple."

The Bordeaux from the sloe is perhaps not now so well known, but many of us have made the acquaintance, either wittingly or in ignorance, of champagne drawn if not from an apple at least from a stalk of rhubarb.

In the matter of the punishment with which the crime of food adulteration was visited, our ancestors acted much more severely, and in that respect I think more wisely than we do in these days. On the continent especially was this the case. Thus we read that a baker who was condemned for selling what was styled "false bread," was adjudged to be taken to several public places in the city dressed only in his shirt, there, having small loaves hung round his neck, and candles in each hand, he had to ask pardon and mercy of God, the king, and justice for his fault.

Another baker guilty of a similar offence was heavily fined, his oven was destroyed, and his shop was closed for six months with a placard on it setting forth the nature of the offence and punishment.

An adulterator of wine was on one occasion punished even more severely. He was forced to drink some of his own wine. The punishment probably was greater than was intended, for, we are told, he died from the effects of his forced potation.

Apart from punishment, however, we have in some respects fallen off sadly in the matter of regulations for selling pure food. For example, in an early Act we find a penalty of £100 directed to be inflicted on any one found keeping or manufacturing any vegetable substance, being an imitation of or intended to serve as a substitute for coffee. But most unfortunately we learn that later on grocers were not only allowed to keep chicory on their premises, but were allowed to sell it mixed with coffee—a step which no doubt paved the way for much of the adulteration that undoubtedly took place some years ago.

I am in possession of a copy of a verbatim report of the pro-

ceedings of a meeting of those interested in the coffee trade, held about thirty years ago in London, and in this report it is recorded that the chairman of the meeting distinctly stated that though now more of what is called coffee is consumed, yet there is less consumpt of genuine coffee. And one individual produced at this meeting a sample of stuff composed of burnt peas, dog biscuit, prepared earth, and another substance which he would not describe, and which mixture, he said, was employed either to adulterate or even as a substitute for that material so largely mixed with coffee—viz., chicory.

Indeed, so far did the refinement of adulteration go that a patent was actually taken out to protect a process which an ingenious inventor had elaborated for the manufacture of a certain mixture of chicory and coffee. This mixture was pressed into the shape of coffee berries, so that retailers of coffee might be fully prepared for those troublesome and fastidious patrons who in order to make certain that they were being really supplied with pure coffee insisted on witnessing themselves the operation of grinding.

But adulteration was practised without much attempt at refinement. It is on record that so unblushing became the process of bread adulteration by means of alum that the alum was sometimes found in a loaf in pieces as big as a large pea. And it was stated in the most open fashion by a witness before a select committee that his firm, in order to give preserved foods, such as vegetables, a taking appearance, boiled them in copper vessels until they assumed a deep enough green tint—in other words, until they had absorbed a sufficient amount of a dangerous poison to make them look better than those sold by other and more conscientious manufacturers. Such an abominable practice as this—and which is, I may remark, carried on in the present day—is altogether and utterly inexcusable, and I think almost justifies the very forcible language of that brave old enemy of adulteration, Accum, when he writes, "that the eager and insatiable thirst for gain which seems to be a leading characteristic of the times calls into action every human faculty, and gives an

irresistible impulse to the power of invention; and when lucre becomes the reigning principle, the possible sacrifice of a fellow-creature's life is a secondary consideration."

Those, then, are a few facts relative to the history of adulteration of food; let me now lay before you one or two statements indicative of the prevalence of this crime.

One very well-known analyst, writing on this part of the subject, states that during six years he examined over 3000 articles of food, and the result was that there were few of these which admitted of adulteration or the adulteration of which was profitable which were not extensively subjected to sophistication. Such an assertion as this is almost incredible, and would, I dare say, have been very generally disbelieved had it not been corroborated by many competent witnesses,—such, for example, as those examined before the Parliamentary Committee on adulteration in 1855. Indeed, such was the nature of the evidence adduced on that occasion that the Committee stated in their report "that they cannot avoid the conclusion that adulteration widely prevails. Not only is the public health thus exposed to danger, and pecuniary fraud committed on the whole community, but the public morality is tainted and the high commercial character of the country seriously lowered both at home and in the eyes of foreign countries."

These are certainly very grave statements, coming from a very high authority. It is satisfactory, however, to remember that they refer to a period of nearly thirty years ago, also that by recent legislation and the consequent appointment of a number of properly trained chemical analysts, matters have in late years in this respect been very much improved. Still, as I shall have occasion to show directly, we are very far even yet from being altogether free of the demon of food adulteration. The practice still exists in our midst, and will continue, I very much fear, until much more stringent measures than at present obtain are enforced for its suppression.

I am not aware of the reason of what I am about to state, but

it always seems to me that offenders against the adulteration laws are very often indeed treated in the most absurdly lenient fashion. I have to appear occasionally in certain courts in different towns in Scotland to give evidence in cases where persons are charged with adulterating human food, and the presiding judge on these occasions invariably appears to assume a half apologetic air in addressing the accused. He orders a chair to be placed for his accommodation, and altogether seems to say: I am really extremely sorry that you should be put to the great inconvenience of coming here, but I hope you clearly understand that it is not in consequence of any action on my part. The case is proceeded with, the charge is found proven, and some of the panel's ill-gotten gains go to pay the small fine which is imposed. The next case which is called is that of some poor half-starved tramp who has taken a fish from the river to make a breakfast for himself and his miserable dependents. There is no apology or chair for him; he is tried and found guilty without loss of time, mercifully fined in a sum greater than he ever at any time could call his own, which not being able to pay, he is straightway bundled off to prison without more ado.

Now I look upon the first of these two offenders as by far the worst. Why, a man who wilfully adulterates human food is worse even than the famous highwaymen of old. These gentlemen of the road mercifully offered one an alternative. Your money *or* your life was their demand—our modern food adulterators not only demand, but most surely take both our money and our lives.

Excuses for Food Adulteration.—As in almost every other case of evil doing we have for the crime of food adulteration numerous excuses. The principal and favourite excuse, albeit a most extraordinary one, is that food is sophisticated in obedience to the tastes and wishes of the public—a curious public certainly, that prefers to be poisoned and robbed rather than be supplied with their money's worth of pure and wholesome food. Then, if this assertion is too much even for the long-suffering credulous British public, we are told that certain forms of admixture are really improvements.

The public, it seems, must have its pickles, bottled fruits, and vegetables, of a bright green; its confectionery must have coats of many colours; its sauces, potted meats, &c., must be red; its cheese and butter must be yellow; and its bread white. Now, while it is true, no doubt, that in some instances the public may like substances which they are going to use as food coloured in this fashion, they certainly would, in the great majority of cases, prefer to have them without the colour, if they were told, as they should be, by what means the colours are produced.

Not very long ago the Public Analyst of Glasgow found that a most beautifully coloured cake, which was exposed for sale in a shop window, owed part at least of its taking appearance to the deadly poison Scheele's green, one of the principal constituents of which is Arsenic. I myself some time ago found a wholesale confectioner in Edinburgh turning out large quantities of beautiful yellow lozenges, which were also coloured by means of a deleterious metallic compound; and pickles and preserved vegetables are sent to me constantly containing compounds of copper or other poisonous substance.

It is, I admit, quite possible that a person in ignorance may prefer bright green peas to those having a sickly greenish yellow hue, but if such an individual be informed that the inviting colour of the otherwise wholesome vegetable is obtained by the admixture of verdigris, or some similar poisonous compound, it is to be presumed that he, not being an inmate of Bedlam, would prefer that which, though not presenting such a bright appearance, might be partaken of in safety. So much then for this alleged insatiable desire of the public to be supplied with adulterated food.

But we are told further that, the wishes of the public entirely apart, some kinds of food are really improved by adulteration, or, as it is more euphoniously put, by admixture. Startling statement certainly, and yet it is made again and again, and not casually or irresponsibly, but authoritatively and of set purpose.

In our Court in Edinburgh, not very long ago, in a case of food adulteration which was tried there, not only did the sellers of the

adulterated stuff maintain that it was better than the pure article, but they had several highly paid witnesses in attendance ready to say the same thing.

Well, I can easily understand that there should exist in the lay mind some little anxiety to know something of these articles which are improved by—let us say admixture.

But first in this connection, let me draw your attention to the curious and suggestive fact that these things which are added by way of "improvement" are always very much cheaper than the article which has been subjected to the improving process. Take, for example, the very common admixture of coffee with chicory. We are told distinctly that the chicory is added for the purpose of improving the coffee, but when we remember that coffee costs somewhere about 2s. per pound and chicory about 4d., we are led, even the most charitable among us, to have some faint suspicion that this very questionable improvement and this solicitous regard for the wishes and tastes of the public resolves itself into a question of gain to the manufacturer or trader. Especially when we remember that this improving process is frequently carried to such an extent that but little of the original substance is discernible in the "improved" compound.

The same may be said of the addition of flour and the yellow dye-stuff known as turmeric to mustard. We are gravely assured, and indeed I have heard it stated on oath by those interested in the sale of this material, that it is altogether a mistake to use it pure. In such a condition we are told that it won't keep, that its taste is not pleasant, and so on. A sufficient answer to all of this nonsense is that certain manufacturers make and sell really pure mustard, and that even if this could not be done, and that if mustard did require a little flour or some similar material to make it keep, it does not require for this purpose anything like the very large amount which is frequently put in. In such cases of necessary admixture, if such cases there be, we should follow the example of a celebrated wit, when he astonished his milkman by appearing himself one morning on his door step, provided with two jugs, and politely re-

quested to be furnished with the milk and water separately, as he intended henceforth to mix them himself.

I remember once of hearing a mustard manufacturer giving evidence on oath as to the mode of manufactuing the mustard he sold. Being asked what was the use or object of putting in the flour which he said his mustard contained, he answered very readily, "To make it keep." Next, the gentleman of the long robe, wishing to know what was the greatest proportion of flour he used for this purpose, was told, evidently frankly enough, as well as I remember, about 20 or 30 per cent. The next question was how much flour is it necessary to add for the effectual preservation of the mustard? About 10 per cent was the ready, but unguarded, reply. Then came the knotty question, For what, then, is the extra 10 or 20 per cent. added? The answer was not very satisfactory, but I think we may all get an answer for ourselves by calling to mind that while the delightful condiment when pure costs 2s. a pound, the useless flour—at least useless here—costs about 1d.

So far indeed was adulteration practised on this plea that it was necessary for the preservation of certain articles that the legislature was actually brought, in the case of one commonly-used article, to sanction an addition of a very questionable nature. I refer to the admixture of oil of vitriol with vinegar.

That such a repulsive blend is altogether unnecessary is proved by the fact that now most, if not all of the vinegar made by the larger and better manufacturers does not contain a drop of sulphuric acid.

When, therefore, you hear of any wholesome article of food which you are in the habit of using being mixed with something else in deference to the taste of the public, or even for the purpose of making it keep, I would advise you to look strictly into the matter for yourselves, and in most of such cases I think you will find that the admixture is made not for these purposes alone.

Another plea sometimes urged in extenuation of adulteration is that it is impossible to supply genuine articles at the price which the public are willing to pay for them. Now no doubt

there is a little in this deserving of attention, but very little. Competition, we know, has the effect of lowering prices and minimising profits, and people, as a rule, like to obtain what they purchase at as cheap a rate as possible. It is, however, the duty of the trader and not the public to fix the prices at which the various commodities can be sold; and if a trader were careful to inform his patrons that while he could not guarantee the genuineness of the very cheap articles he sold, he could do so with all confidence in regard to those which cost a little more—he would not, I think, have cause long to complain of his inability to sell the pure though apparently more expensive articles.

Another excuse, if so it may be called, in defence of adulteration is, that in some forms it does no harm—by which is meant that only innocuous substances, such as water, are used for the purpose of admixture. Thus the addition of water to milk or whisky I have heard characterised as a comparatively venial offence, seeing that it does no harm. But with quite as much reason might it be said that a seller who uses light weights or deficient measures does no harm. Neither offence is the means of us being poisoned, but both assuredly make us pay for that which we have not received.

Different articles used for the purpose of adulteration.—The majority of substances so used are for one of three purposes:—1st, to increase the bulk or weight of the dearer article; 2nd, to brighten or alter its colour; 3rd, to increase its pungency, or, as it is said, to improve its flavour.

The first mode of employing adulterants is the most common. As examples we may mention addition of water to milk, flour to mustard, chicory to coffee, grease of different kinds to butter. As illustrations of the second mode we may take the addition of compounds of copper to preserved vegetables, barley-meal to oat-meal, alum to bread. As examples of the third we may take the addition of pepper to ginger, chemical essences to confectionery, artificial flavourings to wine.

Means of checking adulteration.—These we may say really consist—first of discovery, and second of punishment. As the

second cannot be inflicted until the first has taken place, and as, moreover, the first very often constitutes a very important part of the second in its most salutary form—the first, that is the discovery, becomes of the greatest importance.

The detection of adulteration of food is effected by means of two agencies—chemical analyses and microscopical examination. Alum in bread, copper in vegetables, and water in milk, are all detected by means of analysis, while flour in mustard, barley in oatmeal, starch in pepper, are all discovered by the aid of the microscope.

These examinations, chemical and microscopical, are carried out, as most people are aware, by a body of men known as Public Analysts. These officials have not as yet been very long in existence, and yet, notwithstanding great and manifold forms of opposition, have already, as shown by the table I have suspended on the wall, lessened adulteration to a very great extent.

This table, though, besides showing what Public Analysts have done, shows also what an enormous amount of work they have yet to do. For in looking at this table, it must be remembered that many of the samples of food therein referred to were procured by official inspectors, who are unfortunately too well known to the dealers, and who, therefore,—their errand being known,—are supplied frequently with goods very superior to what are given to the public under the same name.

One of the inspectors in a county in the South of Scotland pointed out to me that so well known was he that one shopkeeper had a stock of bags evidently for his special use. So that whether he bought sugar, tea, or oatmeal, it was always put into a bag, bearing on its face, "Notice—This is sold as a mixture of chicory and coffee."

From this table, to which I have just referred, it will be seen that of all the samples of food sold in the way I have mentioned, no less than 21 per cent. were adulterated, and I have not the slightest doubt that had these samples all been bought by ordinary people in the usual way, the percentage of adulterated samples would have been very much higher.

And I will go a step further and say that had it not been for the apathy of the public, and, indeed, actual opposition shown to public analysts in the discharge of their duties, and in their attempts to provide a purer and more wholesome food supply, the falling off in the number of adulterated articles sold, great as it is, would have been considerably greater.

But, unfortunately, and to me most inexplicably, every one from our administrators of justice downwards seems to wish to deal most leniently, or rather, I should say, manifests a strong desire not to deal at all with this most iniquitous and quite inexcusable practice of food adulteration.

All sorts of pleas are tendered by those accused of this crime, and what to ordinary minds seems the most absurd statements are listened to. A confectioner was convicted of having sold some sweets which he had coloured with the beautiful but poisonous substance chromate of lead. He professed not to be able to account for the presence of this poison in his lozenges, unless, he warily added, a little of the material with which he had recently been painting his yellow cart had got accidently mixed with the sugar.

A dairyman charged with the usual failing of his fraternity gave as his excuse that his cows had lately been fed on hay, and the next comer accused of like unprofessional conduct, and seeing how successful his fellow sinner's explanation had been, and determined not to be outdone, announced triumphantly that his cows had been fed on straw. The pleading was effectual and both men got off.

Another explained that his milk was rather weak but not from adulteration, but simply because the machine which he used for cooling the milk by means of cold water was leaky.

Another asserted that he did not put any water into the milk, but that unfortunately the pails being exposed on a very wet morning while the cows were being milked in the field, he opined that the rain was answerable for the attenuation which had undoubtedly taken place.

Another excuse, and so far a successful one, for selling watered milk, was that the seller was a widow, and, adds the reporter, it

is astonishing how many enterprising widows undertook to sell milk on the strength of that decision.

But this strange desire to shield the adulterator of food from punishment is not confined to those officially concerned. Ordinary people come to me exhibiting the same spirit. They bring samples of food which they wish analysed, not, they explain, with any view of prosecuting the poor man who has sold the material, but simply to see whether that be bad or good. One is inclined to ask what is the use of having an analysis made unless some action is to follow.

But further still, even after a public analyst is appointed, the authorities in many cases exhibit the strangest desire to keep him unemployed. In the year 1880 the analysts of forty-one places reported that they had not analysed a single sample. The results of such a mode of procedure may be well imagined in this money-getting age.

At present I act as public analyst for many different places in Scotland, but I must say that in all of them, except perhaps two, the authorities not only permit but in some instances actually encourage the working of the Food Adulteration Act. In the place where the Act is worked most energetically, namely, in the county of Roxburgh, it is now a very rare thing indeed to get an adulterated sample of food, whereas in Leith, where the authorities do not seem to deem it their duty to enforce the Act at all, a very different state of matters prevail. Not long ago I sent to Leith and had some articles of food bought, and these on being analysed were, every one, found to be adulterated.

But I now pass on to tell you, and it must be very briefly, of the usual adulterants of the more common articles of food. At the head of the list I place milk, not only because it is the most important form of food, but also because it is most unfortunately, in Edinburgh at least, the one most subject to adulteration. Pure milk!—alas, how few of us know what it is—is the principal and natural food of the young, and this being so it is not too much to say that upon the quality of the milk supply

depends to a very great extent indeed the health and well-being of children; and we all know what an important factor that is in determining the future condition of the race.

Of all forms of food, not even excepting bread, milk is the most extensively used. In London alone, according to a recent calculation, the sum paid for milk every year amounts to no less than £1,400,000. This gives us some idea of the enormous amount of milk which is used, and of the amount of money, to say nothing of health, of which we are robbed by the scandalous but very common practice of milk adulteration. Just reflect for a moment that adulteration with water to the extent of only 10 per cent. on the London milk supply infers a loss of about £140,000 a year. We don't consider 10 per cent. of water in a sample of milk very extensive adulteration in Edinburgh; but still it would appear from a report issued by the Local Government Board that even London milk, all over, I mean, is not adulterated to that extent. In that report it is stated that only £70,000 to £80,000 is paid annually in London for water sold as milk.

The only way in which milk is adulterated, at all events in the present day, is by the addition of water, or by the abstraction of cream. All the sensational stories of sheep's brains and chalk being used for this purpose are totally without foundation.

But this form of adulteration, though seemingly simple and comparatively harmless, is yet a very serious matter when we come to consider the extent to which milk is employed as food. The infant mortality, especially among the poorer classes in towns, as everyone having any knowledge of the subject is well aware, is lamentably high; and is this most regretable fact not to be accounted for to a very great extent by the knowledge which we possess of the nature of the miserable innutritious food with which the poor creatures are supplied in the form of skimmed and watered milk? For it is the poor who are not able to protect themselves who suffer principally by this, and indeed by most other forms of food adulteration.

But all of us, whether rich or poor, are liable to suffer from milk adulteration in another way besides that of being deprived

of food. The water, we know, which is found in the wells of farms and dairies is often, for very obvious reasons, extremely impure, and to the practice of adulterating milk to ever so slight an extent with such impure water, is to be ascribed, no doubt, many of these mysterious outbreaks of disease which we hear of every now and again as taking place in our midst. And you must have noticed that these unwelcome visitors are found in Edinburgh's Belgravia as well as in her slums.

I have analysed hundreds of samples of water from different parts of the world during my twenty years' experience—many of them very bad indeed. But one of the worst waters I ever examined was from the well of a milk establishment supplying milk to Edinburgh. It is some comfort, however, to remember that water, such as that I refer to, could hardly now be used in Edinburgh in any way in connection with milk, as all our dairies, &c., are under the inspection of our vigilant officer of health, Dr Littlejohn, who, if he found any such water in any milk establishment, would immediately take such steps as would prevent it being used in the dairy.

The question is often put to me, is there no simple test or form of analysis which could be used by people in general for the purpose of ascertaining whether milk they are about to use is pure? I am sorry always to be compelled to answer this enquiry in the negative. There is, unfortunately, no such test of any value in existence.

Numerous forms of so-called milk testers have been proposed for this purpose, but the indications of all of them are very fallacious. The two best known milk testers are the so-called creamometer and the lactometer. The first is simply a graduated tube divided into one hundred divisions. Into this the milk to be tested is poured until it reaches the top, or zero mark. It is here allowed to repose for twelve hours, or until the cream is supposed to have risen to the surface. The number of divisions occupied by the cream is then read off, and this is supposed to indicate the richness of the milk. Rich and genuine milk will throw up from 10 to 14 divisions of cream, while poor or adulter-

ated milk will show only 8 or 6, or even less, the percentage varying with the extent to which the milk has been diluted or skimmed.

As, however, the rising of cream is dependent upon other things than the richness of the milk, this test is not to be relied on. I had occasion to investigate this matter some years ago, when results obtained by the use of this instrument were made use of to disprove analysis made by me in one of the milk cases then in court. And I found that, by a little manipulation, watered milk could be made to show as good, or even better, results in this creamometer than pure milk.

The other instrument or lactometer is almost equally valueless. It is nothing more than an ordinary hydrometer, which is an instrument made use of to ascertain the relative weights of equal volumes of different liquids.

Milk is heavier than water, and so heavy milk is supposed to be good, but as cream is lighter than milk, a milk which had been skimmed would show better on this instrument than would a genuine milk. And yet these lactometers are used and implicitly believed in as milk-testers by many otherwise well informed people, and it is said, and I suppose truly enough, that at one time certain French officials, whose duty included that of examining milk, were all armed with these lactometers. Thus equipped they perambulated the streets, and whenever they thought proper, they demanded a sample of milk from any dealer. Into this they plunged their lactometer, and if the milk did not come up to the mark, it was forthwith poured into the gutter. In this way, no doubt, many a gallon of good milk was lost.

But the lactometer has been in use nearer home. The governors of one of the London poorhouses inserted in their contract specification the stipulation that the milk supplied to the institution should come up to a certain mark on the lactometer, and for a time they got pretty good milk, until, indeed, in an unfortunate moment one ingenious contractor discovered how the milk was tested, and he soon succeeded—though he supplied only very poor milk—in satisfying the requirements of the lactometer,

and at the same time in making a very good profit. He first of all partially skimmed the milk—that made it too heavy; the lactometer stood too high, so as an inexpensive and effectual corrective, he added a little water, which, of course, made the milk lighter, and so he continued the addition until he brought the lactometer to the right point exactly, thus fulfilling to a nicety and in the most scientific manner the requirements of the governors. The only way as yet known to test milk accurately is by means of a properly conducted chemical analysis, and a description of that process would, I am afraid, be somewhat out of place in this lecture.

The next article of food I wish to speak of is bread, and of this most important substance I am happy to say I have a very different tale to tell from that which I have just told of milk. The bread which is sold in Edinburgh, and indeed in Scotland generally, as far as my experience goes, is very pure. Never yet have I found in Edinburgh bread anything of the nature of adulteration.

As most of you are aware, bread is in some parts of this country adulterated with alum, which is used, so it is said, for the purpose of making the bread white, and for giving bread made from inferior flour the appearance of that made from flour of a better quality. It is asserted also that bread is occasionally adulterated with common salt for the purpose of making it hold more water. Sulphate of copper is another substance said to be put into bread for the purpose of improving its appearance. I have the same story to tell of all these forms of adulteration. I have never found any of them in bread, and I do not think that they are ever employed by the bakers in Edinburgh.

Passing on I come to another important article of food, viz., coffee, and here again we get to another extreme. If there is little or no adulterated bread to be had in Edinburgh, there is hardly such a thing as pure coffee.

Again and again have I instructed the food inspectors to bring me some pure coffee, or to procure what, at all events, is sold as such. The result is almost always the same. Either I am

handed some inferior mixture, or in cases where the inspectors are known, and the object of their visit suspected, they are told by the dealer that he has no pure coffee. This seems to me a most extraordinary and no less unfortunate state of matters.

Coffee in a state of purity is one of the most delightful things we can drink, while the stuff which is sold at the present day in Edinburgh as coffee is only tolerable after our taste has become thoroughly depraved.

The materials used for mixing with coffee are chicory, roasted wheat, beans, date stones, and burnt sugar, all of which yield infusions as different in all respects from coffee, except perhaps as regards colour, as it is possible to conceive.

The extent to which coffee is now adulterated is almost beyond belief. One analyst reported that a sample of so-called coffee which had been sent to him for analysis consisted of chicory flavoured with coffee, and I had a sample not very long ago which might not inaptly have been characterised as burnt sugar flavoured with coffee. One coffee dealer, evidently in haste to be rich, advertised his wares as being "fine French coffee—a blend of the finest East India and other coffees, carefully prepared by a new French process, whereby the aroma and properties of the coffee are fully developed." This enterprising advertiser was, however, somewhat severely fined because his developing process was found to consist solely in the admixture of the enormous proportion of 90 per cent. of chicory. Well, that is rather an exceptional amount, but to find 40 or 50 per cent. of this cheap uninviting root in coffee is not by any means unusual.

We detect chicory in coffee by means of the microscope, and I show you on the table hung on the wall a diagram from which you get an idea of the structure of the coffee berry and the chicory root.

I cannot leave this subject of coffee without putting before you one or two figures showing to what an enormous extent the consumption of this most excellent beverage has fallen off in consequence of the great adulteration to which it has of late years been subjected. This country has, we all know, increased in wealth and in

population very rapidly during the last thirty or forty years, and as a consequence of this the consumption of what we may call the luxuries has increased also very rapidly. Thus in 1843 we consumed of whisky and spirits generally 0·87 gallon per head, and this at the present time has risen to 1·03. In 1843 we consumed of wine 0·22 gallon, and at the present time we consume 0·40 gallon. Of tobacco the consumption in 1843 was 0·84 lb. per head, it is now 1·37. Of tea the quantity used in 1843 was 1·47 lbs. per head, the quantity now used is 4·62 lbs. per head. Of cocoa we used in 1843 0·09 of 1 lb. we now use 0·34 of 1 lb.

And now we come to coffee. The consumption of coffee in 1843 was 1·1 lb. per head, and it increased to 1848 when it was 1·37 lbs. It has since steadily fallen off, and it is now only 0·89. To what are we to look for the explanation of this very remarkable fact, that while the consumption of spirits, wine, tobacco, tea, and cocoa has all increased, the consumption of coffee has very materially decreased. There can be no doubt, I think, that the decrease in the use of coffee is owing to the adulteration to which it is subjected. People are losing their taste for coffee, and no wonder, when instead of getting what must be regarded when pure as one of the most refreshing and delightful of beverages, we get when we ask for coffee an infusion made, in great part, of a root having a sickly, sweet, mawkish. taste, and being entirely destitute of all these valuable, refreshing, and stimulating properties for which coffee is so justly famed.

The next article of which I have to speak is butter, and this also I am forced to admit is still very often adulterated, and often to an enormous extent. Occasionally, indeed, do I receive samples of butter so called, which contain no butter at all, being composed entirely of some kind of foreign grease. This was the case with three samples which I received lately. One of these was bought in a shop in Edinburgh, one was from Leith, and another was from a country town in Dumfriesshire.

The trade in spurious butter is now very large. According to a recent report by the local Government Board no less than six million lbs. of a stuff called Oleo Margarine—whatever that

may mean—are exported annually from New York alone to Rotterdam, Hamburgh, etc. Arrived there this material is mixed with colouring matter and washed or mixed with milk, and then in whole or great part exported to this country.

From another source I have the information that two Dutch butter-making firms use for manufacturing adulterated or spurious butter no less than twenty thousand kilos of Margarine daily. Besides it is well known that this prepared grease is made now to a very large extent in this country.

It is a common observation that this material when clean is really fairly wholesome, and that it is better at all events than rancid butter, which is at present largely consumed by the poorer classes of the community. Be that as it may, there is no doubt whatever that selling this fat as butter is in the highest degree reprehensible. According to some authorities, indeed, selling it for food under any name is wrong, as it is said that frequently the heat employed in its preparation is not sufficient to kill the embryo parasites often found existing in the fat from which it is made, and that in this way this so-called butterine may become an active carrier of disease. On this latter point, however, I have no personal experience.

Butter is also occasionally adulterated with water, and also in some rare instances by the addition of an excessive amount of salt. These, however, are trifling compared to the common and favourite mode of sophistication—the addition of foreign fat.

The detection of the adulteration of butter is a somewhat complicated operation, and can only be done satisfactorily by means of a properly conducted chemical analysis.

The next article I notice is sugar, and this safe and wholesome food is, I am happy to say, almost invariably sold in a state of purity. The only foreign matter which, so far as I can recollect, I ever detected in sugar was ground rice and a small quantity of potash salt. The former had come from the mill in which the sugar had been ground, and the latter had arisen, no doubt, from careless refining. It is, I think, extremely satisfactory to be able to say that in Edinburgh two of the principal materials used as food are supplied to the public in a state of great purity.

Coming to what is, or at all events should be, one of the most important articles of food, viz., oatmeal, I am sorry that I can hardly give it so favourable a character as I gave the bread. As a rule, however, oatmeal is sold in a state of great purity. Occasionally barley meal is found in samples sent for analysis, and this addition is made, so it is said, to give meal made from poor and inferior oats a whiter look and an appearance of meal made from better oats.

Barley meal is, no doubt, occasionally added for this purpose; but the small quantities of this substance which I have detected seem to me to have been introduced rather by accident than design. A few weeks ago I had a sample of oatmeal submitted to me for analysis, in which I detected a notable amount of ground lentils or some similar seed.

The next article, tea, is one which is very largely used at present in this country. In my opinion it is consumed, especially by the working classes, far too liberally. One dose of tea in the twenty-four hours is quite sufficient, and many people, I am quite convinced, who are at present troubled with headaches and many of the so-called nervous diseases, would be far better if they never drank tea at all. Especially I would advise all who hear me now to avoid that very great mistake known as a tea dinner. Tea and butcher meat should never be taken together, at least as forming the principal meal. The tannin, an important constituent of the tea, prevents the digestion of the meat.

The adulterations of tea are few in number. The principal, and I am almost inclined to say in the present time the only adulteration, is the addition to the tea of used tea leaves. The leaves, after having been exhausted in the teapot in the ordinary way, are collected in large quantities, dried, and, if necessary, rerolled and then mixed with fresh leaves.

Sand, impregnated with iron, has also been detected in tea. Green tea is sometimes "faced," as it is called—that is, it is powdered on the surface with different ingredients for the purpose of communicating to the leaves the admired green appearance. Prussian blue, indigo, plaster of Paris, slacked

lime, graphite, and French chalk, have all been employed for this purpose.

As a rule, if we except this green tea, the tea sold in Edinburgh is very pure. The stories of tea being adulterated with the leaves of the sloe, hawthorn, &c., however true they may have been at one time seem altogether destitute of foundation in the present day. In an old Act of Parliament, however, passed in Geo. III. time, we read that "great quantities of sloe leaves and ash and elder and other trees and shrubs were being manufactured and sold as tea, to the injury and destruction of great quantities of timber woods and underwoods."

Passing now from the more substantial articles of food to those which are used only occasionally, and more as adjuncts to the others, I first of all notice that old and justly favourite sweetmeat, honey.

Through all ages this substance has been an important and well-known luxury, and it is not pleasant to relate that in these, our own days, degenerate and money-making as we have become, a large proportion of the stuff sold under the name of the classical dainty is little more than flavoured starch syrup.

My experience of honey has been very bad, every sample which I have examined, so far as my memory serves, having consisted largely of this syrup. And this is pretty nearly the experience of another analyst who examined some samples from America and Switzerland, and found all of them, except two, to be adulterated.

The process of manufacture seems to be very simple. The syrup is first made from starch and oil of vitriol, it is then mixed with a little genuine honey, in order that it may possess the true flavour. This compound is then packed into very neat little jars, furnished with a bright taking label, and sent into the market as honey.

Unfortunately, analysts in their attempts to stop the sale of such a vile concoction as this are not much assisted by the public, who are either careless, or it may be are ignorant of the flavour of true honey—or they are quite content to eat and pay for the product of potatoes and vitriol as honey, so long as it is con-

tained in a package of taking appearance and possessed of a high sounding name. The two things, however, are as different as they well can be.

The honey which I have examined has always been what is known as "strained honey," but I am informed that the potato starch article is to be had in the comb. I have not to my knowledge seen this latest product of adulterating ingenuity, but it is said that the comb is very beautifully made out of white paraffin wax, and looks almost quite as well as the real article.

Unfortunately there is no simple test by which spurious honey can be distinguished from real, except by the taste. Analysts distinguish between the two substances by ascertaining the effect produced upon polarised light by a watery solution of the suspected material. Genuine honey turns a ray of polarised light slightly to the left, while the artificial imitation turns it strongly to the right.

Of preserves, such as jams and jellies, I have very little to say. The only adulteration I can remember of detecting in jam consisted in the substitution of dried and apparently foreign fruit for genuine black currants in the jam of that name.

We have all heard of marmalade being made from turnips, &c. This story I am inclined to believe is founded upon a popular delusion. No doubt jam purporting to be made from more expensive fruits has been shown to consist largely of some cheaper fruit, but with the exception of such admixtures, we may almost say that preserves of this kind are not adulterated.

With regard to preserved fruits and vegetables, many kinds of which seem to be consumed very largely in Edinburgh, these are occasionally impure, and the impurity arises from two causes. First, direct and wilful adulteration; and second, accidental impregnation with a portion of the metal of which the vessel containing the fruit is made.

As an example of the first we may take these beautiful green peas which one sees so often in the shop windows. As far as I can recollect, every sample of these vegetables which I have examined have been adulterated with a poison-

ous compound in the shape of a salt of copper. This adulteration is practised, I need hardly say, for the purpose of communicating the admired bright green colour which these peas possess in so eminent a degree. We have all also heard of pickles being adulterated in the same way. Such an admixture of a poisonous substance with any article of food is of course in the highest degree reprehensible, but to deal so with pickles is perhaps hardly so bad as with peas, seeing that many of us do not eat pickles at all, and that most of us at all events do not eat pickles so freely as we do peas.

As to the accidental admixture of poisonous substances with preserved fruits we may take such things as tinned peaches, pears, &c., as good examples.

In such things I have frequently found a quantity of metallic impurity, arising no doubt from the juice of the fruit having dissolved some of the solder or even of the tin of the vessel in which the fruit was contained. This can hardly perhaps be called adulteration, and yet as the effects of eating such impure food might be very serious, it behoves the sellers of these articles either to assure themselves that their wares are free from poisonous matters or to withdraw them at once from sale. My experience though of this, is that dealers trouble themselves very little in the matter.

Then as to these luxuries of life—confections. These favourites of our early years, I am happy to say, are not now nearly so impure as they used to be. It is positively alarming to read in some of the older books treating of this subject of the substances which were formerly in use for the manufacture of confectionery. In this respect matters have very much improved, and yet not long ago I found a large confectioner in Edinburgh colouring his lozenges, &c., with a yellow metallic compound, and a few months later I had sent to me some lozenges, by eating a few of which one person, at least, was very nearly fatally injured. My analysis revealed the presence of a very considerable amount of metallic poison.

These, however, are exceptional cases, and I believe that now

the confections made, at all events by the larger manufacturers, are very pure, that is, they are free from dangerous impurities.

Perhaps in this connection I should say a word as to the quality of the various forms of aerated water now made in such immense quantities. The best known of these is soda water. This title, to start with, is a misnomer. Soda water, as a rule, contains no soda at all; it is simply water holding in solution a large quantity of carbonic acid, and this escaping when the cork is removed from the bottle gives rise to the admired effervescence.

Lemonade, ginger beer, &c., are simply this so-called soda water sweetened with sugar and flavoured with different essential oils.

These things, so far as I know, are never wilfully rendered impure. In consequence, however, of the use in their manufacture of machinery partly constructed of lead, copper, or other metal liable to be attacked by the materials used in the process, it is no uncommon thing to find these popular beverages contaminated with metallic impurity to an undesirable extent. The presence of such a metal as lead is shown by adding to the water after the effervescence has ceased first a small quantity of hydrochloric acid, and then a liberal dose of hydrosulphuric acid, when a black or brown precipitate will be produced if the soda water is impure.

I have now just to say a few words relative to our three favourite condiments, and I have done. These three substances are vinegar, pepper, and mustard.

The first one, the Vinegar, although not always by any means so pure as it should be, is very seldom wilfully adulterated. The adulterations which we do find at rare intervals are sulphuric acid and water. Generally speaking, vinegar as now sold is of good quality, it possesses a fair degree of strength, and the old idea that the addition of a certain proportion of sulphuric acid was necessary for the preservation of the vinegar seems no longer to prevail. This then is one more item to be added to the unfortunately very short list of these articles of food which can readily be procured in a state of purity.

The second condiment I have enumerated, viz., pepper, is not nearly so free from admixture as vinegar. The substances used for adulterating pepper are said to be somewhat numerous. Among others are enumerated: ground rice, linseed meal, and sand. I cannot say that I ever detected either rice or linseed meal in pepper, but I have on more than one occasion detected the presence of sand.

The last substance on the list, viz., mustard, is adulterated to a very great extent. In fact I very much doubt whether there is any pure mustard sold in Edinburgh at all. If there is, I am convinced it bears a very small proportion to the total amount sold. This, I concede, is very bad, and at first sight it does not seem to say much for the efficiency of the public analyst. It is not the fault, however, of that long-suffering functionary. We have had several cases of mustard adulteration before the courts in different parts of Scotland, and in almost every one the authorities have been non-suited. How this result is arrived at is, I must admit, a little beyond my comprehension; but it seems that, according to the very peculiar Act of Parliament under which we work, that a man may sell mustard mixed with other and cheaper things, in response to a request for mustard, without let or hindrance.

The materials principally used to adulterate mustard are flour and a yellow dye called turmeric. The adulterations, therefore, of mustard, at least the common ones, are not numerous, but they are very prevalent. Pure mustard is, I believe, made and sold; but in consequence, I imagine, of the profit made by selling it being comparatively small, it is sold to a very limited extent only.

One can easily understand that there are very strong inducements, indeed, to sell adulterated mustard. Mustard is mixed, frequently I believe, to the extent of nearly one-fourth of its weight of flour. Flour costs somewhere about 1d. per pound, and mustard costs about 2s., so that if a dealer succeeds, say in disposing of 20 lbs. of mustard adulterated to this extent, he sells 5 lbs. of that which costs about 1d. per lb. at the rate of 2s. In other words, he sells for £1 that which costs less than 1s.

When a maker sells tons in a day instead of pounds, we can easily understand that he will make a very handsome income.

The adulteration of mustard is easily detected by means of the microscope, as you can see for yourselves from the diagram on the wall.

And now I have finished, but just before I close I would like to say a single word about the many abominations that are at present sold under the collective name of patent medicines.

The adulteration of drugs is a very important subject, but I must delay its consideration until another occasion. In the meantime, though I advise you all most strongly to eschew at once and for ever the use of all these medicines, with the wonderful names which, together with the lists of the marvellous cures they have effected, are so widely advertised. I have analysed some of these preparations, and a more complete system of robbery than is inferred by their sale it would be difficult to conceive. I think it is a pity that the composition of these so-called medicines is not so well known as their names and the powers and virtues claimed for them. If that were the case, gullable as we are, especially in the matter of medicines, these worthless concoctions would soon be things of the past.

In the matter of drugs as in the case of food, the efforts of public analysts must, to be successful, be seconded by the action of the public themselves, in whose hands the solution of the problem really lies. If people remain as they are at present, profoundly apathetic apparently as to the purity of the food they consume, all the public analysts that ever were will be insufficient to stamp out the evil; but if these officials be assisted in the discharge of their duties as they ought to be by the public generally, so that transgressors may be detected and punished in such a way that adulteration shall cease to be profitable, then these worst of rogues shall disappear, honest men will come in their place, and we will soon have what every one must admit is of the very greatest importance, so far as health and happiness is concerned, an abundant supply of really pure food.

THE DIGESTION OF FOOD IN RELATION TO HEALTH.

By Dr ANDREW WILSON, F.R.S.E., F.L.S.

Mr Chairman, Ladies, and Gentlemen,—The question, "Why do we eat our dinner?" is one which appears of very plain, matter of fact character, but it is also one, the answer to which, involves a very considerable part of the philosophy of human life, and of animal life at large. If we can properly answer the question, "Why do we eat our dinner?"—which, after all, is only another way of asking why we have any necessity for food-taking and food-getting at all—we shall be able to solve nearly three-fourths, not merely of important questions relating to human physiology, but likewise questions relating to political economy as well. For it cannot be denied that the task of getting food is one which lies heavily on the shoulders of thousands, nay, millions of our fellow-beings. If somehow or other, we had been constructed on a type or plan different from that which obtains in our case, so that there would be no necessity for food-taking and food-getting, human life would no doubt have been relieved of a very considerable amount of strain, and of a considerable amount of evil in addition. But we have nothing to do in this lecture with these somewhat transcendental enquiries. It is our business to-night to take the human frame as we find it, and to endeavour to answer as fairly and plainly as may be the questions, "Why do we eat our dinner—what is the necessity for taking food?" These matters involve inquiry into the reasons why

food is taken, how food is digested, and the rules which should regulate healthy digestion in all its phases. If, therefore, we can gain some broad, even elementary, idea of these points, we may claim to have laid the foundation of a study in physiology of a most interesting kind.

One of the most interesting subjects the physiologist can bring before a popular audience in answering the question I have just proposed, is that phase of human life which consists in the fact that a human being, or indeed any animal (and we might include any plant as well), is in a state of continual change, resulting from the work which, as a living body, it performs. For, at no period of our lives are we exempt from wear and tear. All the actions of life, from the pulsation of the heart to the winking of an eyelid; from the taking of a step, to the lifting of a finger—nay, more, even those subtle changes which pass through the grey matter of our brain, and which are evolved ultimately in the form of muscular action, and in the still more subtle essence of thought—involve wear and tear to the being which is subject to them. This question, "Why do we eat our dinner?" may be shortly answered by saying that the dinner represents matter drawn from the outer world, and calculated to repair the loss to which, in the act of living and being, we are continually subjected. It is very evident if the human being is a machine which is constantly working, it must be subjected to continual repair. Take even the case of a sleeping man—the rise and fall of the chest, the quiver of an eyelid, the faint movement, it may be, of a hand, show you it is not death, but "death's twin brother, sleep," you are contemplating. Although the man is resting from his labours, and though he is enjoying the repose of sleep, it may be said in another sense, that his body is the seat of constant activity. For you cannot still that wonderful pumping mechanism, the heart, which is engaged long before we are born and up till we die, in circulating the vital fluid through our system. Even the dreams which haunt us in our sleep, evince that you have a certain amount of brain-activity in repose; so whilst we repair the body in sleep we are still wasting its sub-

stance in this continual work of living. At no period of life, indeed, are we free from the attack of continual change.

In one of the weird stories for which Balzac was so famous in his day, he describes a man who made a compact with the evil one, and received as a gift from that Satanic source a certain magic skin—the *peau de chagrin* of the novelist. The possession of this skin gave to the man the power of fulfilling any wish, but proportionately to the number of wishes which were executed through the possession of this treasure, the skin itself grew smaller and smaller, and at last shrank away; so that with the accomplishment of the last wish, skin and possessor alike disappeared. Life is like the "skin of chagrin" such as Balzac depicted. Our greatest treasure is one which even in the act of our possessing it, tends to grow smaller by shrinking away in the act of using, but differs also from the magic skin, in having, for a certain period, possibility of repair.

We see clearly, then, that the philosophy of food-taking really involves a large part of the philosophy of life, and it is my duty to attempt to illustrate to you the main features which are represented in this act of food-taking and food-digesting. After we view in an elementary manner the chief stages in this process, it will be necessary to sum up those plain health-laws and health-axioms which may be said to flow from such a study.

In the table which is now placed on the screen before you, you will observe the expenditure of a healthy adult body per day amounts to about 58,650 grains of matter given off from lungs, skin, kidneys, and intestines respectively, and consisting of water, carbonic acid gas, urea, minerals, and organic matters. The amount of wear and tear represented by this waste, it is quite evident must necessitate corresponding repair; and thus to put the matter popularly we discover that a healthy adult receives into his body, per day, about the same amount of matter in the shape of solid food, water, and oxygen gas. In other words, about $8\frac{1}{3}$ lbs. of matter are received by, and given off from, the adult body per day. This is a statement which appears in the light of physiological book-keeping by single entry; but as regards its commercial aspect, it

is quite evident that in a satisfactory balance of the bodily books, we should have not merely to account for income and expenditure but likewise for profit. In this case the profit, not shown certainly in the balance sheet, is represented by the *energy*, or *power of doing work* we receive from our food. When it is considered that the heart of a man in twenty-four hours performs an amount of work which, if concentrated into one huge lift, would raise 120 tons one foot high, it can readily be understood that this literally enormous power of work can only be derived from the food we eat. And when the work of a human body in its entirety for a single day is summed up, we discover the curious and astonishing, but at the same time fully proved fact, that a power of about 3400 foot tons (that is a power which would lift 3400 tons one foot high) is represented in our daily actions and life.

Now it is with the proper preparation of the food or fuel of the body, that we are to-night especially concerned. This constitutes the work of digestion, and considering that its bearing is plain and manifest on the maintenance of health, I think you will agree with me that the subject is one which underlies all other questions of bodily comfort and happiness. Digestion may be defined not as an act of converting food into blood according to the popular view, but rather as that process whereby the food is changed into a fluid capable of being added to the blood, and of thus renewing and repairing it. In this respect, digestion is not merely a chemical process, but likewise involves many intricate physical ones. The chemical processes include the transformation of the various food substances into others, and the splitting up of certain compounds to form other bodies adapted to repair and renew the tissues. The physical processes are equally important, and are represented by those which secure the passage of fluids and other matters through the various membranes involved in the work of digestion, so that the products of the work shall reach the blood in the state best fitted for the repair of that fluid.

Again, it is necessary at this stage to acquire a plain and

popular idea of the nature of a digestive system. This may be described essentially as a tube running through the body of an animal, and into which food is received. In certain animals, such as the worms, this tubular condition of the digestive system is exactly represented. In other animals (notably the sea anemones) the tube is cut short within the body, and the digestive system thus comes to open into the body-cavity; but in all animals above the rank of these latter, the digestive system, where it exists at all, is a tube completely shut off from the interior of the body to which it belongs.

If, now, to this conception of a tube we add another thought, namely, that attached to the sides of the tube certain organs called *digestive glands* are found, we shall have completed a broad but comprehensive idea of the digestive apparatus. These glands are represented by the *salivary glands* of the mouth, by the *liver*, by the *sweetbread*, and by other structures embedded in the walls of the digestive tube; but they one and all have this feature in common, namely, that they pour upon the food in its passage through the tube, the fluids they make or secrete. These fluids, it is needless to say, have the aim and object of acting upon the food so as to digest and elaborate it.

The digestive system of man is thus seen to correspond to the tube-idea in its nature. You observe, in the view now thrown on the screen, the mouth as the anterior opening of the tube, the gullet or œsophagus, the stomach (which is a mere expansion of the tube), and finally, the intestine divided into the small and large intestine—a tube measuring in man some 26 feet.

Such being the digestive apparatus, we have now to consider the stages through which the food passes in its transit through this tube. Digestion may be divided into three stages—firstly, digestion in the mouth; secondly, digestion in the stomach; and thirdly, digestion in the intestine; and we shall find it necessary to pay some little attention to each of these three divisions of the process. From the popular point of view digestion is commonly supposed to be a process which begins and ends in the stomach. On the contrary, I cannot too strongly insist upon you

recognising the fact, that digestion not merely begins in the mouth, but is continued onwards far past the stomach itself. In the mouth, three processes take place. The food is firstly divided by the teeth, this constituting the process of *mastication*. It is secondly mixed with the saliva or "water" of the mouth, this constituting *insalivation*. It is thirdly swallowed, this constituting the process of *deglutition*.

We shall consider, then, these three actions in their order. The teeth number thirty-two in the second or permanent set. In the first set they number only twenty. If we were asked to make a catalogue of our bodily belongings, the probability is we should be inclined to consider the teeth as parts of the bony system, but so far from having any relation to bones, teeth are really structures which belong to the skin, and are therefore "first cousins," if I may so put it, of hairs and nails. We can readily understand this by glancing for a moment at the development of a tooth. The teeth begin in the form of small *papillæ* or projections on the gum or mucous membrane of the mouth. A groove is first formed, and from the floor of this groove the papillæ in question arise. Each tooth has, in fact, such a projection, as a kind of tooth-mould. In due time the edges of the groove grow together and enclose the projections in sacs. Finally, blood-vessels bringing the minerals which are to form the hard parts of the teeth, coat the papillæ or projection with the tooth substance, and thus in due time the tooth emerging from the sac in which it is enclosed, cuts the gum.

Throughout this process, bone has really had nothing whatever to do with the formation of the tooth, and as the gum which is responsible for the tooth's growth is really modified skin, we can understand how the nail and the hair should thus become related to the tooth in their origin. The second set of teeth is produced in the same manner as the first set; and even before the first set has been completed, the germs of the second set are to be seen in process of growth. Cases in which a third tooth has replaced the loss of a second in man are rare, but in many lower animals a continuous succession of teeth may take place throughout life.

In its structure, a tooth consists of three substances. The bulk of it is composed of *dentine* or ivory, consisting of numerous fine tubes. The crown is covered with a layer of hard substance called *enamel,* and the roots are coated with a third substance called *cement.* Internally, the tooth is hollow and contains a pulp. This pulp, rich in blood-vessels and nerves, really represents the papilla on which the tooth was formed. It is when this pulp is exposed, through the tooth decaying, that the pangs of toothache are induced. Sixteen teeth exist in each jaw of man, the arrangement in each jaw being similar. There are thus four incisors, or front teeth ; two canines, or " eye " teeth ; two bicuspids, or pre-molars ; and six molars in each jaw. The last or hindmost molar is called the "wisdom tooth," from the fact that it appears somewhat late in life ; but I possess the acquaintance of several individuals who, having attained mature years, and still lacking the last molar, are by no means believers in the theory that any connection exists between the development of their dental apparatus and intellectual wisdom.

One of the primary rules for health in relation to digestion concerns itself with the *care of the teeth.* It is astonishing to note how few people comparatively attend thoroughly to the health of the teeth. Yet when we consider the important part played by the teeth in digestion, the duty of carefully considering the health of the teeth rises high in importance in the list of physiological details. Primarily, it might well be argued that the possession of thirty-two hard particles within our mouths indicated an important use for these structures ; but, judging from the frequency with which the food is " bolted " both by old and young, it is clear the proper use of the teeth requires to be strongly insisted on by all health-lecturers. There is only one nation, I believe, worse off than ourselves in the matter of teeth—I mean our American cousins. It is lamentable to reflect upon the amount of pain and misery which is incurred by the neglect of simple precautions in the matter of the teeth. Thus, if the teeth are allowed, as they too often are, through sheer

neglect, to become decayed, mastication is a painful process, the food is bolted in masses too large for easy digestion by the stomach, and the first stage of indigestion may thus be produced. Hence the care of the teeth becomes a moral duty in reference to health, and if the teeth are unsuited for their work it equally becomes a moral duty in this respect to seek the aid of the dentist.

The proper care of the teeth is after all a simple enough duty. No mere fluid washes will benefit the teeth. We must use first of all a brush moderately hard, and a dentrifice, such as camphorated chalk or magnesia, will be found amply qualified to satisfy all the requirements of the teeth. Again, the teeth should be brushed morning and night—not across, but up and down—and the night-brushing I esteem the more important of the two, seeing that through its agency we get rid of the particles of food which may have collected in the mouth from the work of the teeth through the day. Left to themselves, the teeth decay through the simple process of the generation of acids, induced by the growth and multiplication, within the mouth, of those minute forms of plant life whose germs everywhere beset us. Should the gums be tender, or a mouth wash of a healthy character be required in addition to the brushing of the teeth, I should recommend you to add a few drops of "Calvert's Dento-Phenolene" to half a tumbler of water, and to use this as a simple lavement for mouth and gums.

The second action which occurs to the food in the mouth is that of insalivation. There is scarcely any fluid of which we are more careless than the water or saliva of the mouth, yet this fluid is of extreme importance in digestion. It is furnished by three pairs of salivary glands—the *parotid glands*—situated in front of the ear, and which become enlarged in the affection known as "mumps;" while the *sub-maxillary* and *sub-lingual glands* lie practically in the floor of the mouth. Each gland opens into the mouth by a tube or duct of its own, and thus pours its fluid into the mouth cavity. It seems to be an ascertained fact that the saliva manufactured by these glands varies in its composition according

to its special source, but the functions of saliva are in themselves clearly made out. Thus it is necessary for proper articulation or speech. It dissolves many substances, and thus aids the sense of taste; it is necessary for the act of swallowing in moistening the food; and lastly, it possesses in man, although not in all animals, a special chemical action on the food. In the table I show you on the screen, saliva is shown to consist of a very large proportion of water—in this respect resembling all other fluids of the body—of minerals, of matters derived from the mouth itself, and of a substance special to the saliva called *ptyalin*. The chemical function of the saliva may be described as acting specially on starchy foods. A piece of stale bread taken into the mouth has its starch acted upon by the saliva, and assumes a sweetish taste. Chemically explained, we find this result due to the fact that the ptyalin acts on the starch and converts it into grape-sugar. A preliminary process of digestion is thus seen to begin in the mouth. Nature, in other words, intends that the starch which forms such an important element of our food, shall be chemically changed in the mouth in the fashion just described by the action of the saliva. The habit of bolting the food, therefore, becomes injurious on other grounds than those already mentioned, inasmuch as starchy foods escape the conversion which it is intended they should undergo.

An interesting point in connection with the work of saliva is that which reminds us that the saliva of infants under eight or nine months old is not fully elaborated, and is therefore incapable of effecting this change on starch. Hence no child under the age mentioned, should be supplied with any starch at all. Milk is the only food which the infant should receive, and I think I am perfectly within bounds in saying that the immense mortality which attends children under one year of life, is largely due to the carelessness and the ignorance which together prompt mothers to feed their children on starchy and other foods for the digestion of which the infant frame is utterly unsuited.

The action of swallowing closes the food-operations with which the mouth is concerned. This is, of course, a highly complex

process, in which the tongue and intricate muscular arrangements of the mouth and throat are called into requisition. Popularly described, we may say that the food is moulded into a bolus, which when about to be swallowed is placed on the back of the tongue, which becomes somewhat hollowed to receive it. The tip of the tongue is then applied to the roof of the mouth, and the bolus is tilted backwards. Next the hinder parts of the mouth are drawn up so as to close the openings of the nose into the mouth. The upper part of the organ of voice, the opening of which is protected by a little lid (or *epiglottis*) seen on the illustration on the screen, is also drawn up towards the root of the tongue. As the morsel passes backwards, this epiglottis closes over the opening of the windpipe, securely protecting the tube in ordinary circumstances against the invasion of food, while the mass of food passes into the upper part of the gullet, and is thereupon seized by the muscular walls of that tube and propelled downwards to the stomach. Swallowing is thus largely involuntary in its nature. Occasionally we meet human beings with the power of returning at will the food to the mouth after it has been swallowed, a process which takes places in the ruminant animals, or those that "chew the cud." In the illustration of the ruminant stomach now shown you, we see the four divisions of that organ. The food when first swallowed passes into the first stomach, thence into the second, and thence is propelled upwards to the mouth. After being remasticated it is returned to the third stomach and then passes to the fourth stomach or *rennet*, which is the true digestive cavity.

The food having arrived in the stomach, we must now glance specially at that organ, and thus enter upon the consideration of the second stage of digestion. The stomach of man is a pear-shaped bag, having its large end lying towards the left side, the small, or intestine, end, lying to the right. The liver occupies a position on the right side of the stomach, the spleen to the left, and the pancreas or sweetbread somewhat below the stomach.

The cubic capacity of the human stomach is about five pints. Lined as it is by a mucous membrane, which is continuous with that

of the throat and mouth, it is seen to exhibit rugæ or folds in the empty condition of the organ, its lining membrane being likewise of a pale pink colour. When food enters the stomach these folds disappear, thus giving increased capacity, while the lining membrane becomes of a deep red colour, through the increased flow of blood which takes place to it. The stomach, in fact, thus practically blushes when food enters it, the increased flow of blood being necessary, to afford the raw material for the secretion or manufacture of the gastric juice. This fluid is the characteristic secretion of the stomach, and is formed in certain glands, which may generally be denominated *gastric glands*, and which are situated in the substance of the stomach's walls. Each gland is essentially a minute bag lined by living cells, and having a dense net-work of blood-vessels (shown you on the screen) surrounding it. The blood borne by these vessels supplies to the cells the raw material; the gastric juice being the manufactured product. This juice is poured out on the food in drops from the little orifices of the glands. Chemically analysed, it is seen to contain a large amount of water along with certain other substances, of which the most characteristic is *pepsin*.

It is a curious fact that the stomach appears to have little or no power of digesting fats, starches, or sugars. The foods over which it does possess a digestive influence are those nitrogenous foods to which reference has already been made in other lectures. Mixed with the gastric juice, these foods appear to be converted into substances called *peptones*, and hydrochloric acid is also found in the gastric juice assisting this conversion. The meaning of this change in the stomach seems to be clear when we consider that, as swallowed, nitrogenous foods are incapable of being absorbed into the blood, whereas, when converted into these *peptones*, they are readily absorbable. Thus the minute vessels of the stomach seem to receive, at this early stage of digestion, a supply of important food, which is directly made use of as an addition to the blood. Part of the structure of the stomach, and likewise of the intestine which succeeds it, consists of muscular tissue, and by this means

the food is made to circulate in the stomach so as to become thoroughly mixed with the gastric juice.

At the close of digestion in the stomach the food is converted into a pulpy mass called *chyme*. Fats, starches, and sugars have undergone little change other than that already described as occurring in the mouth, while the nitrogenous parts of the food have passed into the blood to be conveyed to the liver, and probably to be also utilised in part directly, in the work of repairing the tissues. At the close of digestion in the stomach, the *pylorus*, or intestine-opening of the organ, uncloses, and the food is propelled by the stomach's next contractions into the intestine. The intestine, as I have already said, is divided into the small and large intestine, and it is undoubtedly in the small part of this tube, which extends to the length of about twenty feet, that the chief part of digestion is accomplished. On leaving the stomach, the food or *chyme*, as we may now call it, is mixed with the secretion of the liver, namely *bile*, and with that of the sweetbread or pancreas, namely pancreatic juice.

The liver essentially consists of a collection of minute cells, called *hepatic cells*. Large as the organ is, it is therefore a colony of little living manufacturers of bile, although in addition to this bile-making function, the liver would appear to possess certain other important duties, more or less connected with digestion. In the view now thrown on the screen you observe the distribution of blood-vessels intimately associated with the liver. You may observe that a certain large vein, called the *portal vein*, returning blood from the stomach, intestine, and other organs, enters the liver. We see therefore that the liver may be regarded as an organ placed in the direct track of the impure or venous blood returned from the stomach, intestine, and other organs, and there can be little doubt that into the liver along with this blood there are carried by the portal vein substances absorbed from the digestive system, and which appear to be further elaborated in the liver itself. Meanwhile, along with the bile that is poured on the food after it leaves the stomach, we find the *pancreatic juice* from the sweetbread. This pancreatic juice is of high importance in digestion, for it is known to be the chief digester of

the fats contained in the food, while it likewise has an action on the starches and sugars, and in this respect may be said to supplement in an important degree the work of the saliva of the mouth. The liver used to be regarded as the more important of the two organs in relation to digestion; but the sweetbread from recent researches seems to assume the chief place in this respect, since it appears that chiefly through its action those foods which are not affected by the stomach are chemically broken down and con verted into *chyle*—the fluid which I have already spoken of as being adapted when added to the blood to renew and repair that fluid.

What, then, are the special uses of the bile which the liver makes? It is probably correct to assume that the bile in one sense represents rather a waste product than an actual secretion; that it represents the results of more important work done by the liver than the true aim and end of the liver's action. For one thing we know, that when bile is thrown upon the food, and thus passes into the intestine, the movements of that tube are remarkably stimulated. Again, the bile probably exerts an antiseptic or preservative action on the food, thus preventing too rapid or even injurious chemical change. As a digestive fluid, however, its value appears to be of much less importance than in former years was supposed.

The liver, then, is somewhat of a complex, and as yet imperfectly understood organ. It is, for one thing, the production of a large amount of heat, produced by the chemical changes which are perpetually going on within it. Then, when an animal is fed on starches or sugars, it is found that the liver stores up quantities of a substance called glycogen, which is closely related to starch in its chemical composition. Moreover, this glycogen is readily convertible into sugar. If, therefore, starches and sugars are contained in the food, these do not pass from the digestive system into the blood, but appear to be captured by the liver, and stored up as glycogen.

What, in the last place, may be said to be the meaning of this glycogen storage? The probability is, no satisfactory answer can be returned to this question. It was believed by Claude Bernard that the glycogen was given out by the liver in the

transformed shape of sugar, and that this sugar, conveyed to the heart and lungs, underwent chemical combustion in the blood, and was thus a source of bodily heat. Now, this result certainly occurs in the diseased condition called diabetes; but in health there is no passage of sugar into the blood, and the problem which at present awaits physiological solution resolves itself into the enquiry regarding the destination and fate of the glycogen. That it passes away from the liver in some form or other is a supposition fairly warrantable, and I may rest content by laying before you the assumption that its destination is probably the muscles to which it stands in the relation of a food-supply, giving to these organs the matter which is constantly being "burned off" in them, in the ordinary movements of the body.

Returning now to the small intestine, we discover that its inner membrane is thrown into very conspicuous folds called *valvulæ conniventes*, which serve to increase the digestive surface over which the food has to pass, and thus the milk-like fluid, called chyle, passing along the intestine, is now ready to be carried into the blood. For this purpose special vessels called *absorbents* are provided, and the chyle seems, in the first instance, to strain through the walls of the intestine into the absorbent vessels, the beginnings of which exist within certain minute projections of the intestine, called *villi*. Absorbed by these vessels, the chyle is carried to a tube lying along the right side of the spine, and called the *thoracic duct*, and this duct in turn opens into a large vein at the root of the neck on the left side. It is at this part of the body, therefore, that the junction between the food and the blood takes place, and it is here that those supplies of fresh material required for the continuance of the body's work are added to the great stream which is perpetually flowing through the blood-vessels.

In the diagram of the absorptive system shown you on the screen, you may see how the absorbing vessels also appear to branch all through the body, their duty being that of gathering from all parts of the body the *lymph* or fluid part of the blood which has been used in the act of nutrition; this lymph being gathered up once again into the blood circulation, and used in the repair of the blood.

Lastly, if we for a moment look at the blood itself, and its composition as shown you in the diagram, you note that it is in its way a fluid epitome of the body itself. It contains those corpuscles which begin to appear in the chyle, and in this light we may note in passing, that the *spleen* itself is simply to be viewed as one of the blood glands attached to the absorbent system, and apparently concerned with the work of elaborating and forming the blood-corpuscles. It is the duty of the red corpuscles of the blood more especially to convey the oxygen gas we inhale in breathing to all parts of the body and tissues. Thus from the right side of the heart the venous or impure blood received from the body is perpetually being sent to the lungs; while from the lungs, after purification, the blood is returned to the left side of the heart, for circulation through the body.

The aims and objects of this lecture would be imperfectly discharged did I neglect to summarise, in a closing sentence or two, the chief points which appear to me to contain the gist of scientific experience in relation to the health-aspects of digestion.

Firstly, I should say that those who wish to avoid indigestion, and the train of physical horrors which accompany indigestion, that hydra-headed ailment, should make a special note that perfect mastication and division of the food by the teeth is an essential condition for health. If the stomach receives masses of food too large for easy digestion, its functions become impaired, and the habit of bolting the food is therefore one of those pernicious practices which sooner or later lay the foundation of a train of evils in connection with the imperfect assimilation of food.

In the second instance, where mastication is not perfectly performed, and where the food is not thoroughly broken down in the mouth, the action of the saliva upon the starches of the food is imperfectly carried out; and thus, food which should be chemically altered in the mouth is passed on to the stomach in a state in which nature never intended it should be acted upon in the further course of digestion.

Thirdly, I should strongly insist upon the recognition of the fact that rest after meals is one of the most important points our

attention in this matter of healthy digestion. The work of digesting food really involves a large expenditure of nervous and muscular power, as well as a considerable expenditure of other powers not so readily demonstrated. Viewed in this light it can well be understood that no violent exertion should be indulged in immediately after a meal. The old proverb, "After dinner rest awhile," has thus a physiological justification, and I am fully persuaded that many who suffer from digestive troubles may rid themselves of such troubles by attention to this latter rule.

In the fourth place, I regard the individual culture of health as being the only sure basis on which we can authoritatively speak, each with regard to his own wants and experience in the matter of foods, drinks, and digestion. Those philosophers who talk so glibly about the abuse of alcoholic liquors, ought to be reminded that their remarks might equally well be made to apply to the abuse of tea, coffee, and indeed to other foods and drinks. You cannot lay down laws for the million in this respect. Life can never be regulated by some mathematical rule of three, as some ardent persons amongst us seem to think. It is not the experience of the mass, but that of the individual, wisely formed and appreciated through a knowledge of health laws, which alone can serve as a guide in the choice of the foods and drinks which are most suitable for him.

Lastly, I should not omit to mention that cheerful company at meals is by no means an unimportant addition to healthy digestion. It is, on the contrary, one which is too frequently overlooked, to the detriment, I am persuaded, of our health. It is true this may be a condition not always or readily attainable; but if "a merry heart lives long," as the poet has expressed it, I for one can readily see a justification of the aphorism, in the fact that the happiness thus induced, must both act and react upon the healthy digestion of food.

These, it appears to me, are the chief points to which our attention should be directed in connection with the nourishment of our frames; and to the intelligent enjoyment and personal cultivation of such views, I am persuaded, we shall owe the possession and practice of a healthy and, because a healthy, happy life.

ANNUAL MEETING.

Professor Annandale, Chairman of the Committee, presided at the Annual Meeting of the Society, at which the appended Report was read. About 400 members were present. He intimated that letters of apology had been received from the following gentlemen :—Professor Douglas Maclagan, Bailie Clark, Councillor Dr Russell, and Dr Byrom Bramwell, who all regretted their inability to be present.

In moving the adoption of the Report, the Chairman said :—I am quite sure that you will all agree with me in thanking very sincerely those gentlemen who have given the lectures this session. (Applause.) I feel certain that these lectures have been of great service to those who have heard them, and will be so also to those who may read them in future ; and I hope that all who so know of them will tell others of them, so that the benefit of these lectures will be extended as widely as possible. (Applause.) I cannot help thinking, Ladies and Gentlemen, that in addition to the information that is provided by these lectures there is another good thing in connection with them, and it is this, that they tend to bring together in our audiences all classes of society. (Applause.) I have no sympathy with those who endeavour to set class against class—(applause)—because I think it the duty of every true citizen to bring the different classes together, so that they may know each other better. I am sure they will find they have many sympathies in common ; and although there may be differences of opinion in regard to many things, yet if we men and women only feel and consider these sympathies, it cannot but result in good to us all. (Applause.)

Passing now to the particular lectures which have been given during this session I shall make a remark in regard to the first lecture—that given by Dr Batty Tuke. One of the most important practical points in connection with Dr Tuke's lecture was that in which he referred to what is called "over-pressure" in schools. Well, it is quite possible, I think, that occasionally there may be this "over-pressure;" but I think he touched upon the real point, and that was the question of not only feeding the brain but of feeding the body. (Applause.) We all know that unless the body is kept in a healthy condition by proper food and treatment, it is perfectly impossible the brain can be vigorous and healthy, or in the case of young people that it can be properly developed. Therefore I take this opportunity of asking you to support all those institutions in town — and there are several of them —which have for their object the feeding and clothing of the destitute poor children. (Applause.) It has sometimes occurred to me, Ladies and Gentlemen,—and perhaps I am touching, especially in this hall, on a delicate point, still, as it is my opinion, I give it you for what it is worth,—that if some of the money, energy, and enthusiasm which is expended on what are called foreign missions, were expended in connection with our poor at home, it would be better for our country. (Applause.) I do hope no one here will think that in making this remark, I object in any way to foreign missions; but looking, as I have done, to the results which are obtained in connection with many of them at a great expenditure of labour and money, I cannot help thinking that more important results in every way would have been obtained if that money and energy had been expended in our own country. (Applause.)

Then we come to the second lecture—that of Dr Byrom Bramwell—on "The Causes and Prevention of Disease." Now in my own special profession it is a great matter for us, when we are called upon to treat a disease, to ascertain its cause; because if we can do that, we have of course the best chance of treating it successfully. You all know that "prevention is better than cure," and whenever you can prevent any disease by putting

away its cause, you not only save many lives and much distress, but you will also save much money. (Applause.) If you look at it from a practical point of view—and I am a practical man, because my part of the profession makes me a practical man—(applause)—it comes to this: suppose your house-drains are out of order, and you do not put yourself to the trouble to get them put right, you may be sure that sickness and all its attendant troubles will almost certainly be the result. Fever will break out in the family, perhaps several members are attacked, and you have to call in the doctor,—and the doctor's bills come to something. Then medicines come to something additional, and perhaps paid nurses are also required. Finally, there may be death and all the lamentable expenses of a funeral. Consider then—and this is *practical*, remember—how much actual expense as well as trouble might have been saved if the small amount required to put your drain right had been expended at first. And if, as probably the majority of you are, only tenants of your houses, remember that your landlord is bound by law to keep your house in a sanitary condition, and that if he seems unwilling to do what is necessary to keep it fairly healthy, you should at once bring your case before the Burgh Engineer, or our excellent Town Medical Officer, Dr Littlejohn. Therefore, I say, this lecture of Dr Bramwell's is especially valuable in teaching you some of the causes which produce disease, and how to prevent them.

Then, in regard to Dr Ritchie's lecture on the Bath, it seems to me there has been no lecture more appropriate, because, remembering the saying that "Cleanliness is next to Godliness," we have on a Saturday night the lecture on cleanliness and on the Sunday we are supposed to have a lecture on theology. I need hardly say the lecture was especially valuable, the more so because it has given rise to a very important and practical *leaflet*, which will be largely distributed. I believe this leaflet alone will have great effect in promoting cleanliness among our poor population, because Dr Ritchie has shown in it, by an interesting sketch, that there is no excuse even in the poorest house for the absence of

the bath. All you have to do is to put up a sheet or blanket in a corner, have a tub of water, and there you are. (Laughter.)

Then Professor Cunningham's lecture was also very interesting, especially to our female friends, because they learned from it how many yards of hair they might have if they only took proper care of it. (Laughter.)

In regard to the lecture on Marketing and Cooking, there can be no doubt that, as the report says, it was one of the most important of the series. (Applause.) Now there is nothing more important in connection with true temperance,—and I am very sure of this,—than that the women of our working classes should know how to market economically and cook food which is digestible, and to a certain extent tasteful. Many a man who comes home and finds a dirty or untidy house, and food either not cooked or improperly cooked, and perhaps the money he has left for housekeeping all spent in an uneconomical way, I am sure in many instances takes up his hat, and goes straight off to the public-house; whereas if he had found a tidy house, a clean and *well-cooked* dinner, and however poor it may be, it may always be *that*, he would have gone and washed his hands and face, taken his bath behind a sheet perhaps—(laughter),—and sat down with his wife and children, and enjoyed their simple meal. Then possibly he will say to his wife, if it be a Saturday night, "We have had a comfortable dinner, and not spent much money." We will go to the Health Lecture, and put sixpence in the plate. (Laughter.) Or, if he preferred, he might go to hear the Christy Minstrels, or to see the pantomime, or to have any other rational amusement.

Then we come to the lecture on "The Adulteration of Food," a very important matter. My own personal opinion in regard to it is this, that the inspection of adulterations is not at all satisfactory. I wish that this matter were upon a much more satisfactory footing, and in saying this I mean it should be more satisfactory not only as regards the buyer, but also as regards the seller. Take, for instance, milk. Milk is one of the most important diets, as you all know, not only for adults, but especially

for children. Now many prosecutions in connection with the adulteration of milk have failed, and properly so, for this reason—the authorities have not taken into consideration the condition of the cow which furnishes the milk. My idea is there should not only be careful inspection of the milk itself, but also of the cow which gave the milk, and its surroundings. (Applause.) There are many family men and women here, and all know well that a woman cannot at times nurse her child because she is in a delicate state of health—her milk is not properly nourishing. There are also many temporary conditions — a woman has a shock, or a family row which affects her nervous system, and the result is, the baby who has imbibed her milk has a pain in its stomach next morning. Cows have nerves as well as women, and are sometimes in delicate health as well as women; and the fact really is, that we are often getting milk from delicate cows, or from cows which are temporarily out of health. Now, if in inspecting the milk the condition of the cows is also taken into consideration, then perhaps we should get at some reliable ground on which to prosecute. I should have no sympathy with any who adulterates milk or other human food knowingly; in fact, I should put him in solitary confinement, and feed him upon what he has adulterated. (Laughter.) I think, however, that in some instances the *retail seller* of food, whether milk or otherwise, has been rather hardly dealt with; because he may sometimes get the food with perfect faith from a wholesale dealer who may have adulterated it, and the retail dealer may suffer. Therefore, we want something more thorough in our investigations. We must not only investigate the material itself, but investigate the source. (Applause.) If this were done more thoroughly we should be doing justice not only to the consumer, but to the seller. (Applause.)

Our last lecture was that on the "Digestion of Food," a very important matter. There is one point in connection with it which many scientific people quite ignore altogether, and it is this, that, as the old saying has it, "What is one man's food is another's poison." Although we know many things in regard to ordinary

digestion, many people have individual peculiarities. Every individual, as Dr Andrew Wilson said, should judge for himself and find out what agrees with him and what does not agree with him, and stick to the former. In connection with this it is a well-known fact that some of even the most simple foods are in some instances almost poison to particular people. Mutton, for instance, sometimes, in exceptional cases, acts as poison ; although I hope all of us here to-night can enjoy a leg of mutton without fear of harm. It is for this reason I may impress upon you the necessity not only of attending to the general and ordinary principles of digestion, but also of endeavouring to avoid those things which do not agree with you. (Applause.)

I would now like to say a few words in regard to these little leaflets which have been placed in your hands to-night.* The Health Society Committee were anxious that the public should know exactly what our authorities can do for them in Sanitary matters, and we therefore communicated with the authorities, and they very kindly have, under the direction of Dr Littlejohn, furnished us with this leaflet. We found many people were not aware of what the town would do for them in regard, for instance, to infectious diseases, and in regard to disinfecting houses and clothes; and we hope that by distributing this leaflet, knowledge as to these matters will be widely known and taken advantage of. We are much indebted to the authorities, because they have not only provided this leaflet but have printed it at their own expense. (Applause.)

There is another matter, and a somewhat delicate one, which has not been referred to in the report, but as it is connected with health I would like to refer to it. It is Temperance. I have already referred to this question when speaking of the importance of good cooking and simple food in regard to it. I know there are differences of opinion as to how it may be best promoted, but I hope there is a unanimous feeling among us that Temperance should exist—(applause);—and I think we should all endeavour so far as we can to put a stop to the intemperance which is

* This leaflet is printed on page 186.

undoubtedly one of the saddest things which exist in our country. (Applause.) Now, I cannot but think that this Health Society of ours is doing great work in this direction. We hold that one of the most important things in connection with real temperance, *the* most important in my opinion, is the PRACTICAL EDUCATION OF THE PEOPLE—teaching them what is good for them and what is not good for them, teaching them to have HEALTHY HOMES, CLEANLY BODIES, SIMPLE FOOD AND DRINK, and also PROPER AMUSEMENTS. We have also pointed out the importance of getting hold of the very poor children when they are quite young, and not only teaching them but feeding them and clothing them properly. I think if the Health Society continues its labours in this great educational work, they will certainly be assisting to an appreciable extent this great cause of true Temperance, and not only temperance in drink, but *temperance in all things.*

I would ask you now to look at the Financial Statement at the end of the Report. I am sorry to say this is not satisfactory. Practically speaking, we are not living upon our income. This year we have had to encroach on our capital to the extent of nearly £20. Now, Ladies and Gentlemen, this is not as it should be. If you, as members of this Society, think it is doing good, that it is benefitting all classes, then I think that we are justified in expecting that you should do a little more in the way of adding to our funds. (Applause.) We do not ask for much ;—we do not expend a great deal, as, you know, all our lecturers give their services free, and therefore I think it is scarcely creditable to the citizens of Edinburgh that its Health Society, which is generally acknowledged to be doing good work, and which provides such excellent lectures by distinguished men, should not be able, at least, to pay its way each year. We shall be very happy, therefore, to receive to-night, or at any other time, subscriptions, which will, if possible, take this discredit from us. (Applause.)

I will now conclude by moving the adoption of the Report. (Applause.)

Mr M'Candlish, F.R.S.E., said—I rise with great pleasure to second the motion the Chairman has just made. It scarcely needs anything to be said in commendation of that motion. The very fact of so large a company being assembled here on such a stormy night is a sufficient indication that here at any rate a proper value is placed upon the work of this Society. (Applause.) But I should like, having been asked to take part in this meeting, to express the very great gratitude which I think the community owes to this Society, and to its Council and Office-bearers, for organising the course of lectures about which you, sir, have been giving us so graphic an account. One of the first things perhaps most of us require to learn is to know how very ignorant we are about the commonest affairs of life. I was thinking only to-day about a number of things which everybody supposes that since they were children they could do without any teaching or effort. I daresay few here imagine it is not the easiest thing on earth to walk, but those of us who have gone through the experience of being volunteers know that to walk straight to any given point, and so as not to tread on the heels of the man before you, or allow the man behind to tread on your heels, so as not to stumble on the man on your right hand, or on the man on your left, is a thing that requires a great deal of training and practice. (Applause.) Two friends of mine, within the last few weeks, have begun to receive instruction, one in singing and the other in elocutionary reading. The first thing both of these persons were taught was *how to breathe*. I fancy we all of us imagine we can at least breathe. (Laughter.) But to the great surprise of one of my friends, she was told that for many years she had breathed altogether wrongly. (Laughter.) So she has begun to learn now how to do it. I recollect a friend of mine telling me a number of years ago—a very distinguished and eminent man he was—that it was only when well on in life he happened to take up a friend's eye-glass and apply it to his eye, that he discovered he had not properly *seen* up to that time. A new world was opened up to him, for it turned out that for all these years, although he thought

he saw, he had not really been seeing things properly at all. In the same way I suppose we all imagine we know how to live and keep our health, but those who have listened to the lectures, or read them, or even heard what you, sir, have been saying to us to-night, must have found out that they want a great deal of instruction on these points, and that most of us, during the greater part of our lives, have been going wrong in some particular or other with regard to our health. We are therefore greatly indebted to this Society for the educational process which it has set in operation, and I do not know that there is almost anything more important to men and women than the end which this Society aims at, namely, the securing of good health amongst the community. (Applause.) I fancy that there are—in fact, there is no doubt that there are—endless distinctions between the miserable condition of mortal disease and the happy condition of robust and perfect health, and I should not be at all surprised that many of us were living in utter ignorance of whether we were in good health or not. People are in low spirits, are cross and ill-natured at times, they want energy and force, and these and other such unpleasant things they ascribe to all sorts of causes, while they are *really* the result of not being in good health. And so one great gain such persons would have by attending the course of instruction this Society gives, would be to find out how much more healthy they might be if they chose to take the trouble and give the time and attention required for this most important purpose. There is an interchangeableness of things in this matter as there is in other matters of science. Everybody knows that a certain quantity of heat can be turned into a certain quantity of power or motion, and that a certain quantity of motion can be converted into a certain quantity of heat. In the same way we can convert a certain amount of time and attention into health, and that health again into money. We can, on the other hand, neglect health, and save some present time and attention, but we shall very soon find out our mistake and loss in doing so; whereas if we took things a little more wisely, and saved our health, we should

find that health again is the fruitful source of profitable time, of fresh force, and more money. (Applause.) Then another very important thing brought out by the lectures of this Society is the great value not only of being in health ourselves, but of our neighbours being in health too. We may be at the greatest possible pains to keep ourselves healthy, and have healthy food and houses, but if our next door neighbours neglect these things,—if for instance *they* have bad drains though we have good ones, and fever becomes epidemic in the neighbourhood,—then all our efforts may be frustrated because our neighbours are not so well informed or so careful as ourselves. It becomes, therefore, of the utmost importance that we should do everything in our power to promote the health of the whole community. (Applause.) Then, sir, I would just venture to say that although, like all great discoveries, this great question of sanitary science, which is a comparatively modern discovery, may not make its way in the world with very great rapidity, yet it *will* make its way; and it will certainly do so all the faster through the work of this Society. Because not only does each man and woman who hears or reads these lectures get a great deal of information for themselves, but they become sources of information for others. The facts brought under our notice come home so forcibly to each of us that it is scarcely possible for us to hear or read them without talking about them to other people, and so gradually widening the circle informed as to and interested in these important matters. I will conclude by saying that while health alone is not the only important thing to promote in the community, yet everybody must be convinced that the great mass of misery and sin and suffering which meets us on all sides requires to be combatted by every possible means. I do not believe that moral means alone will prevail without some physical means too, or that physical means alone will prevail without moral means. The two improving forces must go hand in hand. We have to do battle with sin and misery all along the line, and *every* direction in which instruction can be given and influences brought to bear so as to make men more moral, more

happy, and *more healthy*, ought to receive encouragement from all who have the best interests of their fellowmen at heart. (Loud applause.)

The Report was then unanimously adopted.

Councillor M'Intosh, in moving a cordial vote of thanks to the Committee and Office-Bearers of the Society, stated that he—as a member of the Public Health Committee of the Town Council—knew that the authorities were grateful for any assistance and suggestions they might obtain through such a Society as this in carrying out the important public sanitary duties entrusted to them. He would ask the public, however, to have a little patience, and grant them time to carry out all the desirable reforms. In one direction particularly, he said it was necessary to proceed with the greatest caution—viz., in the condemning houses as unfit for human habitation. This could never be done in a wholesale way, but must be done slowly and cautiously, as otherwise the evils of overcrowding, &c., would only be intensified.

The Honorary Secretary, Mr Walter A. Smith, in reply, said,—Ladies and Gentlemen, I have to thank you for the cordial manner in which you have responded to this motion. What I wish, however, particularly to say is this, that the very best thanks you can give to us is that you should all get as many of your friends as you can to join the Society. It is mentioned in the Report that one member of the Society secured through his own exertions 100 members. (Applause.) Now that is a very striking example to keep before you, and one you should all endeavour to follow to the best of your abilities. Roughly speaking, about 600 members joined the Society this year. That is far too small a number, but if each of you did what this friend of ours has done,—I will not ask you to get 100, but if you each only get ten,—then next year we will start with 6000 members, and that will not be too many. Work in that direction as much as you can, and you will so thank us best.

Dr James Ritchie then moved a vote of thanks to the Chair man, and the proceedings terminated.

SANITARY DUTIES & REQUIREMENTS
as provided for in the Public Health and Police Acts.

Advice can be obtained personally or by letter on application to the Health Office, High Street.

The following are the SANITARY OFFICERS :—

THE INSPECTOR OF CLEANING ; THE BURGH ENGINEER OR SURVEYOR;
And THE MEDICAL OFFICER OF HEALTH.

Address—POLICE CHAMBERS, HIGH STREET.

Should a Complaint addressed to any of these Officials not receive prompt attention, and should a reminder remain unnoticed, the Town Clerk should be communicated with, whom failing, the Councillor for the district should at once be appealed to. In all cases, however, the Proprietor or Factor should be applied to in the first instance.

HOUSE.—Landlords are bound to provide that the Dwelling-House is—1st, Dry ; 2nd, In Good Repair ; 3rd, Free from (*a*) Obnoxious Smells, (*b*) Smoke, (*c*) Vermin.

COMMON STAIR.—Should be kept—1st, Clean ; 2nd, Ventilated ; and 3rd, Lighted.

COURT OR BACK GREEN.—Should be kept—1st, Free from Rubbish ; and 2nd, be Drained.

[* POULTRY should on no account be kept within the City.]

BACK LANES OR PUBLIC PASSAGES.—Should be kept—1st, In Good Repair ; and 2nd, Free from Rubbish.

ILLNESS IN THE FAMILY.—I. ORDINARY.—Advice is available to the poor (and in emergencies to all classes) at the Royal Infirmary, Chalmers' Hospital, Sick Children's Hospital, and the various Dispensaries, viz. :—The *Royal*, in Richmond Street ; The *New Town*, in Thistle Street ; The *Cowgate*, in Cowgate ; The *Fountainbridge*, in Fountainbridge ; The *Northern*, in Stockbridge. For the Eye and Ear specially, at Cockburn Street, Cambridge Street, and Thistle Street.—II. INFECTIOUS.—1st. Hospital accommodation is provided in the Infirmary and City Fever Hospitals, and in the Sick Children's Hospital. 2nd. A patient's clothing and bedding are disinfected ; and also patients are removed to Hospital by the Sanitary Officials *free of expense.* Special penalties are attached to the offences of patients exposing themselves in public places and conveyances, or of any one exposing or selling infected articles of clothing, bedding, or furniture. 3rd. Medical Practitioners are bound by the Police Act to report to the Local Authority cases of Infectious Disease in their practice. Dairymen and Milk Sellers are by the Police Act also bound to give information of infectious disease in their families.

VACCINATION is practised gratuitously at all the large Dispensaries.

WATER SUPPLY.—This should be provided either inside dwellings or in close proximity. It is essential that CISTERNS should be covered, and cleaned out at least twice a year. Where there is W.C. accommodation, two cisterns should be supplied—one of which should be for domestic use.

SMOKE NUISANCE.—As this interferes with the ventilation of houses, and destroys the amenity of the city, all are requested to assist the Public Health Committee of the Town Council with evidence as to cases.

This Leaflet is issued by THE EDINBURGH HEALTH SOCIETY with the sanction of THE PUBLIC HEALTH COMMITTEE.

January 1885.

FOURTH ANNUAL REPORT

OF THE

EDINBURGH HEALTH SOCIETY,

SUBMITTED TO THE MEETING OF MEMBERS ON SATURDAY, THE 31ST JANUARY 1885.

THE Committee have pleasure in submitting their Fourth Annual Report of the work done by the Society. As in previous years that work has consisted chiefly in arranging for the delivery of the course of Lectures, which has now just been successfully completed. The Committee believe that the delivery of such Lectures is a considerable factor in arousing public interest in, and educating public opinion regarding, the all-important matters of public sanitation and private domestic health, which lie at the very roots of the Well-being of the nation. The close and intimate connection between the physical and moral condition of the people is daily becoming more and more recognised, and the Committee earnestly trust that in endeavouring to improve the first, they are at the same time having a direct good influence upon the second.

The Lectures during the past Session have covered a wide range of important questions of practical utility, and have been delivered by persons of eminence and authority in their respective subjects. In the first Lecture, on "Certain Social Aspects of Insanity," delivered on the 22d November last, Dr Batty Tuke pointed out that the recent outcry regarding "Over-pressure in Board Schools" might, with much more justice, have been directed against the "under-feeding" of many of the poor children attending these schools, thus indicating the

advisability of making arrangements in connection with the Board Schools in some poor districts for feeding the Destitute Children, who are forced to attend and expected to compete in class work with their better fed companions.

The second Lecture was that given on "The Causes and Prevention of Disease," by Dr Byrom Bramwell, and was full of useful information and excellent advice. Third on the list was that most practical exposition of the important place of "The Bath" in our daily life, by Dr James Ritchie; and this was followed by a Lecture on "The Hair," by Professor D. J. Cunningham of Dublin, which was illustrated by Lime Light views. Among the most successful evenings during the Session was that on which "The Marketing and Cookery Demonstration" was given by Teachers from the Edinburgh School of Cookery, under the superintendence of Miss Guthrie Wright. This was most admirably arranged in every way, and must have suggested to many of the large audience of working men and women, various useful improvements and at the same time economies in their housekeeping arrangements. The next two Lectures, viz., that on "The Adulteration of Food," by our talented City Analyst, Mr Falconer King, F.C.S., and that on "The Digestion of Food in relation to Health," by Dr Andrew Wilson, which was profusely illustrated by beautiful Lime Light views, formed a natural sequence, and brought the Session to a close.

It is with great pleasure that the Committee express their thanks to the Lecturers for their generous and voluntary efforts on behalf of the Society. It must have been gratifying to them as well as to the Committee that the audiences were so large,—the hall having been crowded nearly every night. The Lectures are now being published, and the Committee trust that the Members will assist in their distribution by buying them, and advising their friends to do so also. From some of the Lectures short "Leaflets" have been prepared, giving the practical "Health Lessons" therefrom in plain and simple language, and these are being distributed among the very poor in Edinburgh

through the City Missions and other agencies. They can be had on application to the Honorary Secretary at the price of 2s. 6d. a hundred. The Committee would also direct the particular attention of the Members and the Public to a Leaflet they have arranged to issue with the special sanction of the Public Health Committee of the City, specifying Sanitary Duties and Requirements as provided for in the Public Health and Police Acts. It is hoped that these Leaflets will be placed in the hands of Members at the Annual Meeting along with this Report, and the Committee recommend that they be carefully read and kept for reference. The Committee desire to thank the Town Authorities for printing this Leaflet and giving the use of it to the Society.

The Committee have had during the past year various matters of public interest under discussion, and amongst those regarding which they have taken action is the insanitary condition of the Water of Leith. They also issued a circular to all the large shops in Edinburgh, respectfully requesting the proprietors to provide seats in their establishments for the women and girls in their employment. The Committee are glad to understand that the City Authorities have decided in establishing Public Baths and Washing-Houses in the Old Town; and they beg to express their hearty thanks to the Town Council for having secured for the citizens that splendid new Health Resort, —Blackford Hill.

The Members will be pleased to learn that in October last the Committee received a Special Certificate of Thanks from the Jury Commission of the International Health Exhibition held in London last year, for the work done by the Society.

During the year 593 Members have been enrolled to the Society. The number during the previous year was 603.

The Committee would again urge all Members to endeavour to get as many of their friends as possible to join the Society next year. As an instance of what may be done by individual effort in this direction, it may be stated that nearly 100 Members were this year obtained through the exertions of *one* Member of the Society. The Committee are anxious to carry out their wish,

referred to in previous reports, to establish a Gymnasium or Recreation Hall; but they cannot do so without a very large number of Members providing the necessary subscriptions. From the Treasurer's Report appended hereto, it will be seen that the ordinary Income of the Society was only £68, 6s. 5d., falling short of the ordinary Expenditure to the extent of £19, 10s. 7d. The Committee cannot help feeling somewhat disappointed with this result, and trust that the Public will afford them more generous support in future years.

The Rev. C. J. Ridgeway retired from the Committee some months ago owing to his leaving Edinburgh. The Committee were sorry to lose him as a colleague, but the Rev. P. M'Adam Muir of Morningside kindly consented to take his place. The Committee recommend that Mr Muir's election be now confirmed. The following five Members of Committee now fall to retire in accordance with the rules, viz.:—Bailie Clark, Dr Affleck, Dr Foulis, Mr Yorston, and Mrs Fraser. They all offer themselves for re-election, with the exception of Dr Affleck; and in room of that gentleman the Committee recommend that Dr Alexander James be elected to the Committee.

Reported on behalf of the Committee by

THOS ANNANDALE, *Chairman.*
WALTER A. SMITH, *Hon. Secretary.*

EDINBURGH, 31*st January* 1885.

*** *All Communications should be addressed to the Honorary Secretary, Falcon Lodge, Murrayfield.*

ABSTRACT of the ACCOUNTS of COLIN M'CUAIG, Esq., C.A., as Honorary Treasurer of THE EDINBURGH HEALTH SOCIETY—*From 29th February 1884 to 31st January 1885.*

I.—CAPITAL ACCOUNT.

To Balance of Funds in favour of the Society as at 29th February 1884,			£133	12	8
,, 17 Life Members' Subscriptions,			17	17	0
			£151	9	8
By Balance *against* Ordinary Revenue Account, brought up,				£19	10	7
,, Balance of Funds in favour of the Society at 31st January 1885—						
On Deposit Receipt with Commercial Bank of Australia, at 5 per cent. Interest,	£100	0	0			
In National Bank, on c/a,	£32	11	4			
Less due Treasurer,	0	12	3			
				31	19	1
				131	19	1
				£151	9	8

II.—ORDINARY REVENUE AND EXPENDITURE FOR YEAR.

To 574 Annual Members' Subscriptions (average 1/5),			£40	7	6
,, *Less* reserved to meet Cost of Copies of Lectures,			2	10	0
			£37	17	6
,, Collections at Doors,			15	9	0
,, Royalties on Lectures,			10	0	0
,, Interest on Deposit Receipt and on Bank Account,			4	19	11
Total Ordinary Income for year,			£68	6	5
Balance *against* Revenue, carried to Capital Account,			19	10	7
			£87	17	0
By Advertising,			£27	8	10
,, Rent of Hall,			18	18	0
,, Printing,			21	0	6
,, Postages, Porterage, &c.,			1	7	0
,, Expenses at Lectures,			14	14	8
,, Stationery,			4	8	0
Total Expenditure for year,			£87	17	0

COLIN M'CUAIG, *Hon. Treasurer.*

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SPECIAL NOTICE—BONUS YEAR, 1885.

General Revision of Rates and Conditions of Assurance.

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GENERAL REVISION OF RATES, 1885.

IN entering on the FORTY-SIXTH YEAR of the ASSOCIATION, the DIRECTORS have caused a careful revision to be made of the RATES of PREMIUM and CONDITIONS of ASSURANCE. The Rates have been recalculated on the most exact data available at the present time, and new Conditions have been introduced into the Contract of Assurance, conferring

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It will be found that, in point of ECONOMY the NEW RATES compare favourably with those of any other office; and the attention of the public is particularly directed to the

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GLASGOW: 105 ST VINCENT ST.,	JOHN OSWALD, *Secretary.* JAMES FINLAYSON, M.D., *Physician.*
DUBLIN: 41 LOWER SACKVILLE ST.,	DAVID DRIMMIE & SONS, *Secretaries.* W. THORNLEY STOKER, M.D., *Physician.*

*** *The* NEW PROSPECTUS, *containing the Revised Tables of Premiums and full information as to the Extended Conditions of Assurance, and also Forms of Proposals may be had at any of the Offices or Agencies of the Association.*

EDINBURGH
HEALTH SOCIETY.

INSTITUTED 1881.

PRESIDENT.

THE RIGHT HON. THE EARL OF ROSEBERY.

THIS SOCIETY has been formed:—

To promote, *by all means in its power*, attention to personal and domestic Cleanliness, to Comfort, Self-denial, Temperance, and the Laws of Health generally.

The means to be employed for this end may, in the opinion of the Committee, be stated in the meantime as follows:—

1. The delivery of Popular Lectures bearing on the subjects in question by Physicians and other qualified persons.
2. The printing and distribution of these Lectures, and of small Leaflets.
3. Providing subjects of Interest for the Mind, and encouraging proper Amusements and Physical Exercises.
4. Giving assistance to the Constituted Authorities in the promotion of sanitary improvements by drawing their special attention to any particular insanitary condition.
5. Obtaining the assistance, so far as necessary, of any other Society in the City willing to co-operate in the work of this Society.
6. Arranging for the *re*-delivery of the Society's Lectures in villages in the neighbourhood of Edinburgh, and for the formation in such places of small *local* Committees in connection with the Society.

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